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A. C. Shand, Chief Engineer of the Pennsylvania Railroad, makes the following comparative statement of rail failures on the lines east of Pittsburg and Erie:

"During the year 1901 there were removed from main running tracks on the Pennsylvania Railroad east of Pittsburg and Erie, 675 defective rails, a very large portion of these, however, were not broken, but were rails that were not properly holding up under the traffic and were what is commonly known as 'mashing' on account of the loads passing over them. This represents 46.6 rails removed from tracks on account of defects for every 1,000,000,000 tons of freight moved one mile. In the year 1905 there were removed 1,747 defective rails, or 90 rails per 1,000,000,000 tons moved one mile. Not one-tenth of these rails were broken."

The rest of the statement is a deserved advertisement of the safety of passenger travel on the Pennsylvania, a safety obtained by vigilance and a high grade of inspection. But Mr. Shand makes the unusual deduction from his figures that, "The Pennsylvania Railroad has little cause for complaint on account of defective rails," although the failures in proportion to tonnage were nearly twice as great in 1905 as they were in 1901. Moreover, the overwhelming evidence of bad rail making developed during the year 1906, and that year is not referred to in the comparison. Another general officer of the Pennsylvania made, in April of this year, the following statement of present conditions which would seem to indicate that if Mr. Shand would bring his statistics up to date they might be still more enlightening, although less valuable as an advertisement of safety on the Pennsylvania:

"We have been in danger in the past, but we are in more danger at the present time. We received one lot of rails this year from a mill; they travelled but a short distance on the cars, and there were eight of those rails broken when they arrived at their destination. We unloaded those rails as carefully as we could on skids, sliding them down so they would not strike, and there were seven broken in unloading. Now, that shows that you are not making as good a rail as you were some time ago, and yet you see the danger we are in, and until you make an open hearth or some other better kind of rail we are still in greater danger."

The Perry theory of boiler efficiency as developed under the auspices of the United States Geological Survey (see paper on Boiler Efficiencies in another column) promises to be of a value that it is difficult to estimate. As stated in the resumé of the scope of the work, its verification will result in "placing the steam boiler on a fairly secure mathematical basis." The first statement of the theory would be more than apt to excite the skepticism of any one familiar with the data available regarding boiler practice, it is so startling in its novelty. But when it is presented from a source of such undoubted honesty, and when this presentation is accompanied by a statement to the effect that the experiments that have been made have verified the theory to a wonderful degree, it must attract respectful attention. With such promises of a final establishment of the theory, it goes without saying that the future bulletins that shall be issued by the department will be awaited with a high degree of interest. The theory is by no means new, since it was set forth several years ago; but, while it attracted attention at the time, it was regarded more as the theory of an individual than a statement of a general law that must command respect as such. Further, it lacked, at the time, the corroborative experimental data needed to establish its correctness, and it is this experimental data that the United States Geological Survey has taken it upon itself to provide.

BAD RAILS BY BAD MAKERS.

The present attitude of the United States Steel Corporation is not unlike that of its principal predecessor in the days when money getting was his sole object and possible enforcement of law and penalties for violated contracts constituted his restraint. His not infrequent smiling answer to indignant remonstrance was: "Why didn't you get it from me in writing?" Or, in other cases: "Look at the penalty clause; there's your liquidated damages." The attitude of the rail makers, while not precisely comparable, has a like result of tonnage, reckless tonnage, ignoring the increasing losses of life and property due to bad tonnage; relying on the restraint due to the power to divert traffic from any one railroad to prevent any one railroad company from insisting on good tonnage; relying also on its arrangement with foreign makers for restraint of competition, sustained by the United States protective tariff of about $7 a ton.

During the early period of rising indignation and protest from a few outspoken railroad officers, the steel company was silent. Later, as if in reply, we had statements of the number of months ahead for which the capacity of the mills was booked. This year

the possibility of some recognition of the charge that the rail product was bad was foreshadowed in its report as follows: "Since January 1, 1907, the orders received have been somewhat less than they were during the months immediately preceding that date." Soon after this came a childish statement by one of the heads of the steel corporation that rails break because of increasing wheel loads. Following this first indication of attention there has been an indirect and non-authoritative spreading abroad of the statement that rails are now being made according to the wishes of the consumers, who want and get cheap rails; that if better rails are demanded the price will be increased to a degree not yet intimated.

For about five years the steel company has maintained a somewhat uniform price, during slack times and flush times, and has earned by this one action the approval of thinking people because of its conservative and tempering effect. It is only in recent years that greed for tonnage and its profits has led to increasing adulteration of the product, and this is made possible by an undue protective tariff on imported rails, as well as by control of an enormous traffic which can be diverted from one railroad to another. We all recognize that "trusts" are dangerous, and here is the most conspicuous modern example of a trust imperious, with its power for injury to the whole people derived from a kindly paternal law and the lack of united action by the railroads.

It may be well to repeat one at a time in order that the non-technical man may more fully appreciate them, some of the bad practices in rail making. Only about three-quarters of a Bessemer steel ingot, even after it is elongated and compressed to a bloom, consists of tough homogeneous steel. In the upper part of the ingot, which cools last, pipe holes occur and the phosphorus, silicon and other constituents are "segregated" from the iron—the steel is not homogeneous and strong. It is decidedly unfit material for rails. That due to this cause alone many rails are treacherous and liable to cause loss of life was plainly shown in eight of the twelve photographs of broken rails shown in this paper for May 17 on pages 676, 677 and 678. The rail makers now cut off and discard from 10 to 12 per cent. of the ingot. It has been conclusively shown by experience that unless an average of something like 25 per cent. is rejected many of the resulting rails are not simply dangerous, they are sure to break, and the only element of uncertainty is the loss involved in that foreordained failure.

It would seem that with full knowledge by the railroad officer and the rail maker of this one defect, too small a discard from the top of the ingot, there would be nothing left to discuss. The railroad company wants rails that are safe for 15 to 20 years, not those that are unsafe for 15 to 20 weeks. The rail maker wants a sale for the greatest possible tonnage, but it is not conceivable that he hopes for a permanently increased demand due to a heavy percentage of failure of bad product. No, his answer may be expected to be that he cannot remelt and use this increased discard from the ingot in Bessemer steel rails; that, although this discard might be used in open hearth steel, it would take some years to get such open hearth plant in operation, and there are other objections. Meantime, before taking any step toward improvement, and while defiantly continuing to produce more than 150,000 tons a month of rails with a heavy percentage of a kind doomed to break, he is ready to consider an agreement for an increased price. This is a hold-up similar to that of a powerful and reckless trade union, and needs to be treated with similar methods to secure the same end. Tariff protection for dishonest product is not justifiable and combined action can baffle threats of traffic diversion.

THE NEW HAVEN-BOSTON & MAINE ANTI-MERGER LAW.

The passage with outward unanimity of the New Haven-Boston & Maine anti-merger bill by the Massachusetts legislature again reminds one how the wave of corporation restriction, starting at the West, has surged over conservative New England. Vermont two or three months ago enacted drastic railroad legislation that makes many of the wild western statutes seem tame. New Hampshire, at about the same time, had her wrestle with the railroads, but along more ethical and common sense lines. And, later, in the last tepid days of a long legislative session, Massachusetts, too, has taken her throw out of the railroads. In the Massachusetts episode there was an antecedent element of comedy. Boston went into convulsions of dread when it was announced that President Mellen might sell out his Sound fleet to Mr. Morse. Boston next reverted to effusive gratitude when the Morse offer of $20,000,000 was declined. And then, in yet a new revulsion of feeling, Boston joined with outer Massachusetts in angry condemnation of the New Haven-Boston & Maine merger and Beacon Street made pact with Berkshire in resisting it. In it all, doubtless, as reported, was a deep vein of politics. Each party feared the other party would "get the drop" on it in an anti-merger appeal to the people at the next state election. But this is a mere sidelight on one of the most remarkable pieces of legislation that ever emerged from under the gills of the symbolic and sacred codfish.

Reversing the order of nature the ostensible sting of the law is in its head. The first section prohibits any railroad corporation of the state or "any person or corporation acting in its interests," from acquiring or attempting to acquire in any way any shares of a domestic railroad company. No such corporation, or any person acting in its behalf, before next July shall vote or attempt to vote on any stock already acquired or "attempt to exercise, directly or indirectly, any control, direction, supervision or influence whatsoever over the acts or doings of such domestic corporation by virtue of such holdings of stock therein." On the domestic corporation, by the next section, a similar prohibition is laid against like acts of the persons or corporation that has acquired stock, and at the annual meeting the election is nullified if less than a majority of stock is represented. Other sections of a somewhat prolix measure give large powers to the railroad commissioners to restrict consolidation, and require that, in consolidation, there shall be no increase of freight rates or fares, or of the united capital stock of the merged companies or decrease of transportation facilities. The penal clause is not only pungent but applies to partnership, trustee and persons as well as corporations, which for violation of the act must be punished—in the case of the corporation—by a fine of $10,000 for each offence and persons by a fine of $1,000 for each offense or not less than six months or more than a year imprisonment, or such fine and imprisonment both.

Passing by the act as a curio in railroad statute-making and viewing it seriously, it has one or two interesting constitutional aspects. Its root idea is, obviously, the theory that a corporation is absolutely the creation and creature of the state in which all individual interests are submerged. But how about the same corporation's rights in other states? The Boston & Maine has charter and statutory powers in New Hampshire, and, if we are not mistaken, in Maine also. Can a law of Massachusetts bind the investments of a Boston & Maine stockholder in New Hampshire, Maine, Connecticut or New York? Where would be the legal line in conflicting legislation on the subject in Massachusetts and New Hampshire? What, in international law, is called the principle of exterritoriality thus becomes in the case of such a sweeping and radical statute important as well as complicated. Again, corporation statutes of the kind usually attack acts and almost exclusively corporation acts done by officers. But here is a unique statute not only leveled at individuals chiefly but at *motive*. It goes beyond the materialisms and invades the airy domain of psychology. Perhaps it is a laical view but one is tempted to inquire also whether in such cases, as a fundamental proposition, there is not a personal and basic right belonging to the citizen such as the right of purchase, sale and bargain. Certainly the vague and indeterminate theory of the "police power" of a state must be strained far to include some of the provisions of this singular "psychological" law of Massachusetts. Tried out in the courts and carried to the highest tribunal of the land the decision would be interesting both in tenor and text.

But the act is not to traverse the tedious and mazy path of litigation. The New Haven corporation has elected to submit, "stand pat" and await the action of the next Massachusetts legislature. This creates a situation almost as unique as the anti-merger law itself. Neither party to the merger can act. Meanwhile, as the sequel of transfers previous to the passage of the law, the New Haven owns—through its agents—about 120,000 shares of Boston & Maine stock, or about two-fifths of all the capital outstanding, and under ordinary conditions sufficient for control. The official announcement that this stock will not—as indeed is forbidden by the law—be voted, only complicates a condition in which the merger is hung up between wind and water. Can the state of Massachusetts ever by the severest of "psychological" statutes prevent Boston & Maine management from being amenable to the actual control even if not immediately, directly and formally exercised? Meantime large plans of improvement must pause, the positive benefits of a merger be postponed and all the delays and risks of an anomalous railroad interregnum be incurred. In the case of the swift and progressive policy of President Mellen this means a good deal. In the interval the state of Massachusetts can exercise its de-

tective faculty in bringing to light the telepathic relation between the two great corporations and solving some of the problems of railroad mysticism. One of them, by the way, may possibly be a subtle harmony of their attitude on the demurrage rule.

A little more common sense, less politics and an appeal to experience would have steered the Massachusetts law-makers to a different port. They would have descried manifest destiny in the merger of two connecting corporations owning properties only in the slightest degree competitive. They would have seen the public benefits to accrue from the dominant policy of a corporation which has been aggressive and expansive as compared with a corporation which has not cultivated its transportation field. They would have let go unheeded the "monopoly" cry in times when it is peculiarly a restraint on unjust railroad aggression; and, searching deeper into the facts, they would have found that, during the last fifteen years, the complete monopoly of southern New England has made a far better record in reduction of freight rates and fares than the incomplete monopoly of southern New England or the fiercely assailed Boston & Albany, which is no monopoly at all. Along with such reasonings would have come thoughts of what consolidation would have wrought in the way of improved inland subsidiary service on the one hand and the more important coastwise service on the other. The merger proposition might have justified some mild restrictive conditions coupled with the permit to go ahead. Instead there has been a statute so radical as to be fantastic and a perilous delay that awaits the dawn of legislative intelligence.

HEAVY FREIGHT TRAINS.

In Mr. Priestley's report on American railroads to the Indian Government, he emphasizes and reiterates again and again the use and value of statistics as they are compiled in the United States. Their chief value is attributed to the fact that they enable a railroad manager to compare the performances of to-day with those of yesterday or last month or last year and thus put himself in a position to curb losses and estimate the value of improvements. To those who are not in immediate charge, the interest in comparative statistics lies in the fact that they make it possible to keep posted as to the progress of events and the changes that have taken place in the methods of obtaining the same results or in doing the same thing. Thus attention has been called in these columns, from time to time, to the growth and development of the modern car and locomotive from those in use 25 or 30 years ago, and the changes have been startling. Most of this present condition has, however, come upon us so gradually that it is difficult to realize what it means until we resort to our comparative statistics and note what has actually been accomplished.

For example the gulf between the freight train weights of 10 years ago and now is greater than appears to the casual observer. To the man on the street there is but little difference in the appearance of the freight train of 1896 and of 1906. If he had counted the cars on some of our principal lines then and now he would have found what to him would seem an insignificant increase. For instance, he would have found trains averaging about 47 cars long on a number of roads in 1896, and that these had grown to about 52 in 1901, and to 56 in 1906. To be sure, this represents a growth of something more than 19 per cent. in train length in 10 years; but, at the same time, he would have found that on some roads there had been an actual falling off in the number of cars hauled per train. In the case of the Middle division of the Pennsylvania, for example, which probably stands for the heaviest traffic on the line, there has been a steady decrease in the number of cars hauled per train during these 10 years. In 1896, the average number of cars loaded and empty hauled per train over this division was 54.52. In 1901 it had fallen to 50.04, and in 1906 to 42.83. So that it is evidently necessary to go behind mere external appearances in order to obtain a correct idea of what is being done.

That the growth of the car capacity has been very great we all know. It has risen from an average maximum of about 60,000 lbs. to 110,000 lbs., and if a comparison of engine sizes were to be made on the same basis as that of train lengths first outlined we would find that, taking cylinder capacity as the standard, the 19-in. by 24-in. cylinder of 1896 had grown to 22 in. by 26 in. in 1901 and to 22 in. by 28 in. in 1906. And when this increase is coupled to a rise in steam pressure from about 165 lbs. to 200 lbs., the tractive power of the locomotive rises accordingly and we find that its increase has been about two-fold, or from 20,000 to 40,000 lbs. This, of course, means that the actual tonnage hauled has increased in some relative proportion, for these heavy locomotives are not built, except in rare instances, to do the work of the lighter power that preceded them.

Taking the Middle division of the Pennsylvania as a concrete example of this we find that the average weight of the trains was 1,326.11 tons in 1896; 1,448.63 tons in 1901, and 1,540.95 tons in 1906. As for the tractive power of the typical consolidation locomotives in these three years, it was 23,040 lbs. for the first year and 39,688 lbs. for the last two; thus showing an increase of about 72.26 per cent. in tractive power and but 16.2 per cent. in the average weight of the train hauled. This must not be taken to mean that the extra increase in engine power is wasted, because in the figures given it is the average train load that is considered, and this includes not only all loading up to the capacity rating of the engine but light and empty trains, by which the requirements of railroad service will invariably cut the average down to a point far below the maximum. Where the figures are available and it is possible to separate the train weights in the direction of traffic from the empty haulage, the relation between the tractive effort of the engine and train weights is naturally much closer. For example, on the Chicago & Alton, on the double-track line between Bloomington and Brighton Park, the engines used in 1896 had cylinders 18 in. by 24 in. and a tractive power of 18,176 lbs.; in 1901, the cylinders were 21 in. diameter by 32 in. stroke, and the tractive power was 42,090 lbs.; in 1906 these figures were 22 in. by 30 in. and 43,305 lbs. Meanwhile the train tonnage northbound was 1,350, 2,700 and 3,206 tons for the three years, respectively. A comparison of the increases for the three years may be stated as follows:

	Tractive power.	Train weights.
1896	1.00	1.00
1901	2.32	2.00
1906	2.33	2.37

This illustration shows that, in this case, at least, the engine rating has increased in almost exactly the same ratio as the tractive power. The greater increase of the former is undoubtedly due to the lower resistance per ton of the heavy train as compared with the light one; though in this instance there was a marked increase in the number of cars. In 1896 the train referred to contained thirty 60,000-lb. capacity cars, while in 1906 there were 56 cars of 100,000 lbs. capacity.

In collecting data regarding heavy train loads a letter from the superintendent of motive power of the Pittsburg & Lake Erie states that the "heaviest freight engines have 21 in. by 30 in. cylinders, with 50-in. drivers, and carry 200 lbs. of steam, with a tractive power of 44,100 lbs. The average revenue train load for 1906 was 1,188 tons. This is probably the heaviest hauled by any railroad in the country. Were the southbound tonnage equal to the northbound, this train load could easily be run up to 2,000 tons. The rating for the engines given above is 3,500 tons, but they have hauled 4,200 tons and have made very good time. The train load for the past few years has increased about 8 per cent. yearly."

On the Mohawk division of the New York Central the drawbar pull of the standard freight locomotives was 20,600 lbs. in 1896; 31,200 lbs. in 1901, and 47,100 lbs. in 1906, and the average number of eastbound cars hauled in the three years was 46, 56 and 67, carrying a tonnage of 1,301, 1,834 and 2,421 respectively.

The Philadelphia & Reading tells the same story of a marked increase. Here the southbound tonnage from Reading to Philadelphia was from 1,950 tons in 1896 to 2,910 tons in 1901 and 3,300 tons in 1906. With the increased length of train and the greater weight of cars and engines, there has also come a slower average speed over the division in some cases, though this is not always true. The Middle division of the Pennsylvania is a notable exception to what appears to be the ordinary rule. For example, the time of slow trains was 11 hrs. 13 min. in 1896; 14 hrs. 29 min. in 1901, and 11 hrs. 47 min. in 1906; while that of preferred trains dropped from 9 hrs. 32 min. in 1901 to 7 hrs. 46 min. in 1906, showing that the facilities for handling the traffic have more than kept pace with the increase of tractive power and engine rating, since the time of delays has dropped from three to two hours, thus somewhat lowering the running speed, which is probably due to the higher proportional rating of the locomotive. This is, however, an exceptional state of affairs; for, in most cases the time required to cover a division has increased; increased both in the actual running time and in the delays, showing that not only is the speed slower because of the probable higher engine rating but that the traffic facilities for handling trains has not always kept pace with the increase of train load as combined with the greater number of trains, although in some cases the latter is not a factor of appreciable importance. An instance of this is found in one

road where the average delays increased from 2 minutes to 1 hour and 3 minutes between 1896 and 1906, while but one train a day was added. Yet the average length of train was increased more than 45 per cent. In this case the delays can undoubtedly be traced to inadequate terminal facilities, as the yard that has to handle this traffic has been built up by accretions and is not particularly well adapted for rapid work with long trains. Other roads that show the same running speed as formerly present the same record of increase of delay time; while others again show both the falling off in running speed and increase of delay time that has been referred to, in some cases the delays having risen from 25 to 50 per cent. on an already liberal margin.

Now by reverting to the conditions set forth in the early portion of this paper we find that on the Pennsylvania Middle division there has been an actual falling off in train lengths so that yard capacity has merely been obliged to keep pace with the increase in the number of trains which is apparently a far easier proposition than that of providing for extra and often extraordinary train lengths. In this case the traffic rose from 30 trains per day in 1896, to 45 trains in 1901 and 50 in 1906; and, as already stated, the delays dropped from three to two hours. There may be other causes contributing to this excellent showing, but it certainly does appear to be a fine demonstration of the value of keeping train lengths down to such dimensions that they are readily handled in the yards, a condition that can only be economically attained where heavy motive power is worked, by the liberal and almost exclusive use of cars of high capacity.

Of course it is quite impossible to make a comparison of train lengths between different roads that would be of the slightest value because of the natural differences in the character of the traffic, grades, power, cars and terminal facilities; but, by comparing the past and present performances of individual roads, a general average of the increase of work done per train can be obtained, and this will probably average an increase that can be estimated at not far from 60 per cent.; though, in individual cases, it will rise much higher than this. This latter is especially true where superintendents have gone tonnage mad and put up engine ratings to a point where delays and slow time will cut out all profit; and, in this, experience seems to show that short trains are better than long ones.

The elements that make for this increase of train load and render it of the greatest value are, taking the track to be of a suitable character, first the heavy power, then high capacity cars, and then suitable yard facilities. In this the high capacity car plays an important role by facilitating yard movements, and it appears to be of prime importance that the train should be made of a length that can be readily handled instead of being increased to such dimensions as to add to the delays that must always be vexatious under the best of conditions. Superintendents and managers are coming to a better realization of this and see that long trains are not always the most profitable. While it would be hazardous to say what will be the ultimate weight and length of train on any road, it is at least interesting to note the great advance that has been made along these lines during the past 10 years, the means by which it has been accomplished and the results that have been attained.

Train Accidents in May.[1]

Our record of train accidents occurring on the railroads of the United States in May includes seven collisions and 21 derailments, 28 accidents in all. This record is not published in full, as was formerly done, except in the cases of the few accidents which are especially prominent—in the present instance two collisions and one derailment. The record of "ordinary" accidents—which term includes, for our present purpose, only those which result in fatal injury to a passenger or an employee or which are of special interest to operating officers—will henceforth be given as below, in the shape of a one-line item for each accident, showing date, location, class and number of deaths and injuries.

This record is based on accounts published in local daily newspapers, except in the cases of accidents of such magnitude that it seems proper to send a letter of inquiry to the railroad manager. The official accident record published quarterly by the Interstate Commerce Commission is regularly reprinted in the *Railroad Gazette*.

Only one accident in May was decidedly prominent as compared with the rest. That was the derailment at Honda, Cal., on the 11th. This accident was reported in the *Railroad Gazette* of May 17, page 691, though the number of casualties proves to have been much larger than was then reported. Of the 55 injuries to passengers, however, 45 are classed as slight. The cause of the accident could not be determined. An officer of the road says that a board of inquiry consisting of three general and four division officers, assisted by others, investigated the circumstances thoroughly, yet found it impossible to decide as to the cause. The members of the board felt sure it was not a defective switch. The train was running at regular but not unusually high speed.

One other accident caused the death of six persons and a third one killed four. The six men killed (at Dayton, Tenn., on the 21st) were miners riding from their work to their homes on coke cars which, it appears, are regularly used for this purpose. The car in which the victims were riding was at the rear of a short train and it was struck by some runaway cars which had escaped from a side track where they were being moved by means of a pinch bar and hand power, with the intention of changing their position slightly to facilitate unloading. The point where they escaped control was on a grade of about 35 ft. to the mile, and the cars soon attained such speed that they overtook the car carrying the miners. These men saw their danger but their own train was moving so fast that they dared not jump off.

The third prominent accident was the butting collision at Rosby's Rock, W. Va. A passenger train collided with a freight while the latter was entering a side track. There was a dense fog at the time, and it is said that although a flagman was sent out by the freight, the engineman of the passenger train did not see him.

Among the usual newspaper reports of accidents to electric cars in the month of May we find six cases which were accompanied by fatal injuries, the total number of deaths in these six cases being 12 or more, and of injuries 123. In one rear collision at Elyria, Ohio, seven persons were killed and six injured; and in collisions at Brooklyn, N. Y.; Akron, Ohio, and Bowling Green, Ohio, the aggregate number of casualties was 112.

TRAIN ACCIDENTS IN THE UNITED STATES—MAY, 1907.

Collisions.

Date.	Road.	Place.	Kind of Accident.	Kind of Train.	No. persons reported Killd.	No. persons reported Inj'd.
6.	Lake Shore & M. S.	Kalamazoo.	xc.	Ft.	1	1
7.	*Baltimore & Ohio*	Rosby's Rock.	bc.	P. & Ft.	4	3
8.	Boston & Albany	Red Bridge.	bc.	Ft. & Ft.	0	8
9.	Cin., Ham. & Dayton.	Jones Station.	rc.	P. & Ft.	1	3
10.	Southern Pacific	Lordsburg.	xc.	Pass.	2	1
21.	P., C., C. & St. L.	Hollidays Cove.	bc.	Ft. & Ft.	1	7
21.		Dayton, Tenn.	xc.	Ft.	6	6

Derailments.

Date.	Road.	Place.	Kind of train.	Cause of derail't.	No. persons reported Killd.	No. persons reported Inj'd.
1.	Baltimore & Ohio	Pleasant View.	Pass.	dr.	0	20
*2.	Central of Georgia	Orchard Hill.	Pass.	d. switch.	1	2
4.	Santa Fe.	Timpas.	Pass.	eq.	0	10
4.	Chic., Burl. & Quincy.	Manhattan.	Pass.	acc. obst.	1	7
†*9.	Chic., Burl. & Quincy.	Lawndale.	Pass.	dr.	1	20
†10.	Cin., Flemingsbg & S.E.	Flemingsburg.	Pass.	dr.	2	15
11.	St. Louis & S. F.	Altus.	Ft.	ms.	1	2
†*11.	*Southern Pacific*	Honda.	Pass.	unx.	32	65
12.	Mo., Kan. & Texas.	Milford.	Ft.	unx.	2	1
13.	Chic., R. I. & Pac.	Marlow.	Ft.	acc. obst.	3	0
13.	T. & O. C.	Truro.	Pass.	ms.	1	4
16.	Southern	Chattanooga.	Ft.	unf.	3	3
17.	Pennsylvania	Tidioute.	Ft.	unx.	2	1
21.	N. Y. C. & H. R.	Finks Basin.	Pass.	acc. obst.	1	2
†22.	Chesapeake & Ohio.	Marysville.	Pass.	dr.	1	2
†22.	Southern Pacific	West Glendale.	Pass.	malice.	1	22
23.	Southern.	Atlanta.	Ft.	ms.	1	0
27.	El Paso & S. W.	Mastedon.	Pass.	dr.	1	1
27.	Lake Shore & M. S.	Northeast.	Ft.	boiler.	1	1
29.	Southern Pacific	Bradley.	Pass.	unx.	2	1
31.	Chic., Burl. & Quincy.	Hunewell.	Ft.	unx.	1	2

Boiler Efficiencies.

Experiments now being conducted by the boiler division of the United States Geological Survey fuel-testing plant at St. Louis, Mo., on the nature of boiler efficiencies have suggested that stationary boilers ought to be made to do ten to twenty times as much work per unit of heating surface as they do now.

This great increase in capacity is to be attained by subdividing the heating surface and water streams more finely and by allowing less restriction of the water inside the boilers and by using high

[1] Abbreviations used in Accident List:
rc.....Rear collision.
bc.....Butting collision.
xc.....Other collisions; as at crossings or in yards. Where only one train is mentioned, it is usually a case of a train running into a standing car or cars, or a collision due to a train breaking in two on a descending grade.
b.....Broken.
d.....Defective.
dr.....Defect of roadway.
eq.....Defect in car or engine.
n.....Negligence.
unf.....Unforeseen obstruction.
unx.....Unexplained.
derail.....Open derailing switch (negligence of engineman or signalman).
ms.....Misplaced switch.
acc. obst..Accidental obstruction.
malice....Malicious obstruction of track or misplacement of switch.
boiler.....Explosion of boiler of locomotive on road.
fire.....Cars burned while running.
Pass.....Passenger train.
Ft.....Freight train (includes empty, engines, work trains, etc.).
*Wreck wholly or partly destroyed by fire.
†One or more passengers killed.

forced and induced draft to put a large mass of gases through the boiler at a very high speed.

Up to the present time there have been only vague ideas among engineers as to what factors influenced the efficiency of the steam boiler portion of the steam generator apparatus so as to cause it to absorb more or less of the heat generated by the combustion. John Perry, a distinguished mechanical and electrical engineer of England, went into the subject mathematically a few years ago and set forth general conclusions tentatively in his book on the "Steam Engine and Gas and Oil Engines."

About a year ago the government testing plant took up the mathematical investigation of the theory of the steam boiler and of heat absorption, and extended Mr. Perry's theory somewhat. For some weeks past Walter T. Ray, assistant engineer, acting under the supervision of Prof. L. P. Breckenridge, engineer-in-charge of the boiler division, has been conducting a series of experiments on small multi-tubular boilers so dimensioned as to enable the theory to be verified, or modified, or refuted. The boilers are fed with air heated electrically. Mr. Perry's theory states that modifying conditions being omitted from consideration, every boiler will always absorb by convection from the gases passing through it, the same percentage of heat which could possibly be absorbed by any boiler containing water at a given steam temperature. This efficiency is, therefore, independent of the temperature of the entering gases and of the amount of gases flowing through the boiler. Of course, it must be understood that the above statement of the theory is slightly subject to modification even theoretically, and more so in practice.

As a practical example, assume that the water in a boiler circulates with entire freedom, which is an unwarranted assumption, and that its temperature is 300 deg. F.; let the gases enter the boiler at 1,300 deg. F., then the difference between the two is 1,000 deg. F., and consequently it would be possible for a boiler infinitely long to reduce the temperature of the gases passing through it to 300 deg. F. Let us assume, however, that the gases leave the boiler at 500 deg. F., which is 200 deg. above steam temperature. The efficiency of the boiler then is 80 per cent., because it has reduced the temperature 800 deg. out of a possible reduction of 1,000 deg.

If the same boiler be supplied with gases at 2,300 deg. F., the gases enter the boiler at 2,000 deg. F., above steam temperature. Mr. Perry's theory states that this particular boiler will reduce these gases 80 per cent. as much in temperature as would a boiler infinitely long; that is, to 400 deg. above steam temperature, which is 20 per cent. of 2,000 deg., or to 700 deg. F. It will be noticed that the mass of gases does not enter into consideration at all.

This surprising deduction is being accurately verified by the aforementioned division of the survey, from which it is found, when keeping other conditions the same and when keeping the initial temperature of the gases constant, that the final temperature of the air remains the same, whatever the amount of air sent through the boiler per second. So far the upper limit has not been reached with tubes clean inside and out, although the rate of evaporation has already been pushed up to many times that obtained even in locomotive practice.

Perry's theory takes into consideration four fundamental features affecting heat absorption at any point of the heating surface:

First—Temperature difference between the gases outside any portion of the boiler tube and the water inside.

Second—The number of molecules per cubic inch in the gases outside the boiler tube.

Third—The specific heat of the gases at constant pressure.

Fourth—The velocity of the gases parallel to the heating surface.

Of the four above factors, only the first has usually been considered. It will be readily seen that if we increase the temperature of the gases we decrease the number of molecules beating against any square inch of tube heating surface, and thus the second factor largely neutralizes the first, especially at high furnace temperatures.

The third factor can be taken as constant equal to .24.

The fourth factor is the new and surprising one. Mr. Perry considers that a high velocity of gases parallel to the heating surface scrubs off more or less of the dense film of gases adhering to the metal surface, which film of gases has already become cold by proximity to the metal. The higher the velocity of gases the more the scrubbing effect, and consequently the greater the amount of heat transmitted. This theory necessarily assumes that the ability of the metal to transmit heat is practically infinite, and when we consider that we ordinarily never put through a boiler tube more than 1/1000 of heat it could possibly carry, it will be realized that this assumption is warranted.

Mr. Perry's theory and the Survey's verification of it will result in placing the steam boiler on a fairly secure mathematical basis, the same as generators and motors are now on. Thus far the experiments check out the theory excellently. The theory and results will be embodied in a special bulletin to be published in two or three months, to be followed by later bulletins as the work proceeds.

The Iles-Murrayville Cut-Off of the Alton.

The cut-off which the Chicago & Alton has been building from Iles, Ill., a point just below Springfield on its Chicago-St. Louis line, to Murrayville, on its Kansas City line, has been completed, and it is expected to have trains running over it about the first of August. The Kansas City line leaves the main, or Chicago-St. Louis line, at Bloomington, running southwest to Roodhouse, where it is joined by a northerly branch from St. Louis, Roodhouse being the division point for the eastern and western divisions of the system. The present Bloomington-Roodhouse line is unsuited for heavy-tonnage freight or high-speed passenger operation, because of its numerous curves and 0.8 and 1 per cent. grades. Traffic requirements to and from the western territory necessitated either revising and rebuilding the old line or some other provision to permit maximum tonnage freight trains to be run from Roodhouse to Chicago.

The Alton's heaviest tonnage is in coal from the fields at and south of Springfield, and the Chicago-St. Louis line had already been rebuilt for the most part to a gradient and curvature suitable for this traffic. It is now double-tracked between Chicago and Bloomington, 126.6 miles, and between Lawndale and Iles, 37.6 miles, and the gap of 23 miles from Bloomington to Lawndale is to be completed in the near future. By building a cut-off from Iles, which is 2.2 miles south of Springfield, to Murrayville, 10 miles above Roodhouse, a low-grade line about five miles shorter than the existing line between Roodhouse and Bloomington was obtained at about what it would have cost to revise and rebuild the old line. Also the cut-off traverses considerable territory not previously served by a railroad.

The cut-off is 34.34 miles long. In one respect it is remarkable, in that it is a tangent for its entire length except for the junction curves with the two existing lines, these being 1 deg. at Iles and 20 mins. at Murrayville. The controlling gradient is 0.3 per cent. both ways. The country traversed is nearly level and the line is located for its entire length on the divide between Sangamon river on the north and Apple creek on the south. There are, therefore, no waterway crossings requiring bridges. There are three crossings with other railroads. At two of these the grades are separated. The third is temporarily a grade crossing protected by interlocking, the plans for which have been approved by the Illinois Railroad and Warehouse Commission. Ultimately these grades also will be separated. Avoidance of the two grade crossings first mentioned increased the cost of the line by more than 10 per cent. Many highway crossings also have been avoided, the grade of the line being quite high throughout its length. The line is gravel ballasted throughout and laid with 80-lb. rails. It is to be equipped with automatic block signals in conformity with the Alton main line practice. There are five stations on the cut-off, named Cockrell, Knapp, Prouty, Yeomans and Clements, after the members of the Interstate Commerce Commission as it was constituted at the time the names were assigned. Following is a brief comparative summary of the new line and present line between Roodhouse and Bloomington:

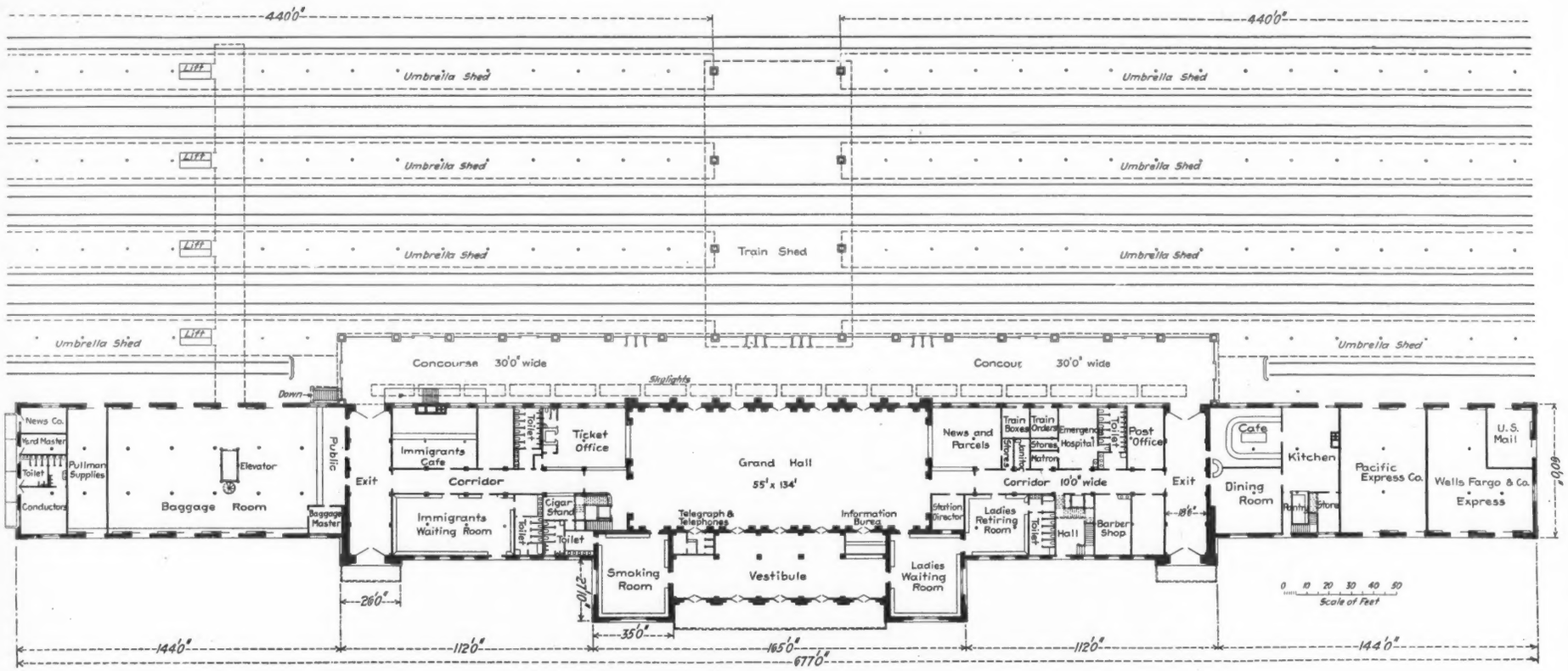
	Via Jacksonville, (old line).	Via Springfield, (new line).
Distance, miles	110.5	105.4
Total rise, ascending grades, ft.	1,059.0	512.0
Total fall, descending grades, ft.	934.0	387.0
Total degrees curvature	940.0	226.0
Maximum degrees of curvature	5.0	2.0
Controlling grade northbound, ft. per mile	38.6	15.8
Controlling grade southbound, ft. per mile	52.8	37.4

New Station, Yard and Terminal Facilities of the Harriman Lines at Salt Lake City.

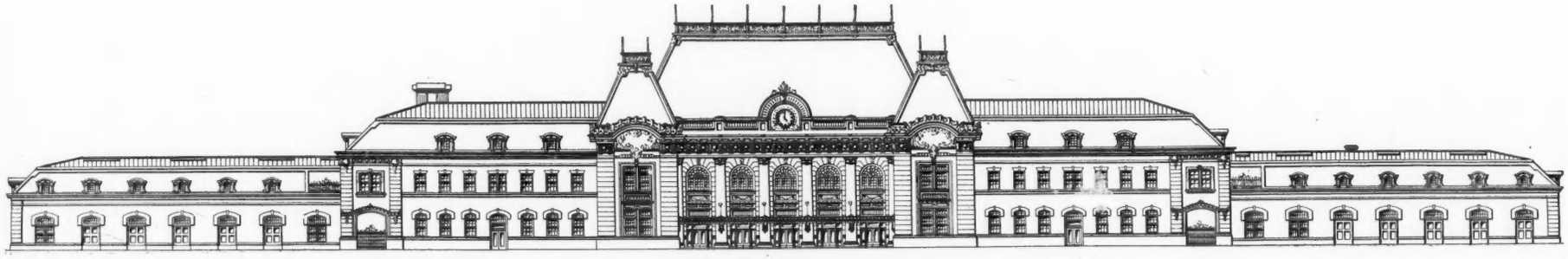
A view and brief description of the proposed new union station to be built at Salt Lake City, Utah, by the Oregon Short Line for the joint use of the Harriman lines centering there were given in our issue of January 25. Through the courtesy of J. D. Isaacs, Consulting Engineer of Bridges, Buildings and Signals for these lines, we are now enabled to present a more complete description, with plans and elevations from the architect's drawings.

In planning the station, careful study was given to securing the most desirable arrangement for the handling and comfort of its patrons. The location is ideal. It is in the center of South Temple street at the axis of West Third, affording a fine view of the building from East Temple street through rows of boxelder trees which line each side of South Temple street. The building is 677 ft. long over all by 70 ft. wide, with a height for the central portion of 100 ft. to the top of roof cresting. The entrances, five in number, leading to a spacious vestibule, are in the center of the main facade and are protected by a wide marquee supported by ornamental iron brackets and heavy chains.

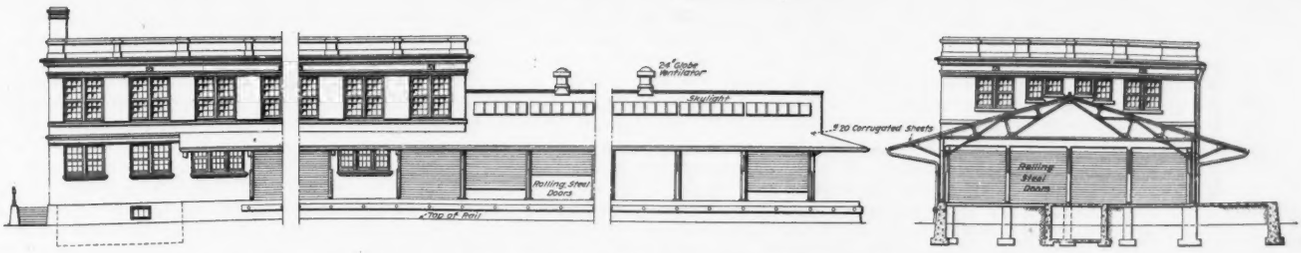
The vestibule opens into the general waiting room or grand



General Plan of Proposed Salt Lake City Union Station for the Harriman Lines.



Proposed Union Passenger Station for the Harriman Lines at Salt Lake City, Utah.

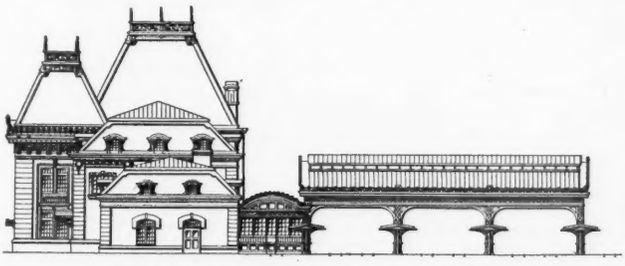


New Freight House at Salt Lake City; Harriman Lines.

hall, 55 ft. wide by 135 ft. long, with a vaulted ceiling two stories high from the spring of the arch, the ceiling being 60 ft. above the main floor. At the left or south of the general waiting room, separated from it only by a counter and screen, are the railroad and Pullman ticket offices and the telegraph and telephone offices; the news and parcel stands and the information bureau are at the north or opposite end of this room.

The two bays or towers flanking the central portion are occupied by the women's waiting room on the right and the men's smoking room on the left. In connection with the women's waiting room are a large retiring room, toilets, etc., and the remainder of this two-story wing contains the emergency hospital, station director's and matron's rooms and a branch postoffice. In the westerly two-story wing are the cigar stand, emigrants' waiting room, cafe, toilets, etc. Passengers coming from the trains do not enter the main waiting room, but pass through wide exits at each end of the two-story wings, going directly to the street or cab stands.

The baggage room occupies the extreme western wing. It has a basement floor below and a low mezzanine story above the ground floor for the storage of baggage not immediately called for. It is reached by a central corridor leading directly from the general waiting room. A telpherage system of transferring baggage will be installed throughout these three floors, with a large elevator



End Elevation; Salt Lake City Station.

running from the mezzanine to the basement floor. A passage or subway on the level of the basement floor runs transversely under all the tracks, having hydraulic lifts between each series of tracks, so that baggage can be loaded on a truck and taken directly to the car by way of the subway and lift without cutting any of the trains. In the extreme eastern wing will be a large cafe and dining room, express rooms, quarters for the Pullman Company, and rooms for trainmen, conductors, etc., with all necessary toilets and lavatories.

The second floor is reached by two stairways and elevators, one at the western end of the general waiting room, the other from a street entrance at the opposite end. On this floor are the offices of the several roads which will use the station. These offices are arranged on each side of a wide corridor. On the three sides of the general waiting room is an observation corridor for the use of the public and patrons, giving a view of the entire floor of the general waiting room.

At the rear or track side of the building is a one-story concourse, 50 ft. wide by 390 ft. long, with steel roof. This concourse is open on the track side above a height of 6 ft., but is arranged to be closed with sash during the winter season. Spanning the tracks transversely is an open train shed 40 ft. wide, with open lattice columns, architecturally designed, and of a height to allow the free passage of trains. This shed will protect passengers in bad weather. Between each series of tracks, and extending each way from the central train shed 400 ft., will be umbrella sheds 16 ft. wide and 10 ft. 6 in. high. The heating plant and other machinery will be located in a room in the basement.

In selecting a method of treatment the renaissance of the French school was adopted, and great care has been exercised to carry out the detail in true proportions as to ornamentation and application of same, so as not to make the building too ornate or overburdened with enrichment. Color effect of the materials for both the exterior and interior has entered largely into the design to produce a harmonious composition. The base or plinth above the ground line will be faced with finely tooled granite, while the walls above will be of brick with the outer face of pressed brick of a warm tone of buff, and the panels between windows of the central portion on the street elevation of Sienna marble. All belt courses, the water table and the entire cornice entablature will be of terra cotta of a color to match the brick work.

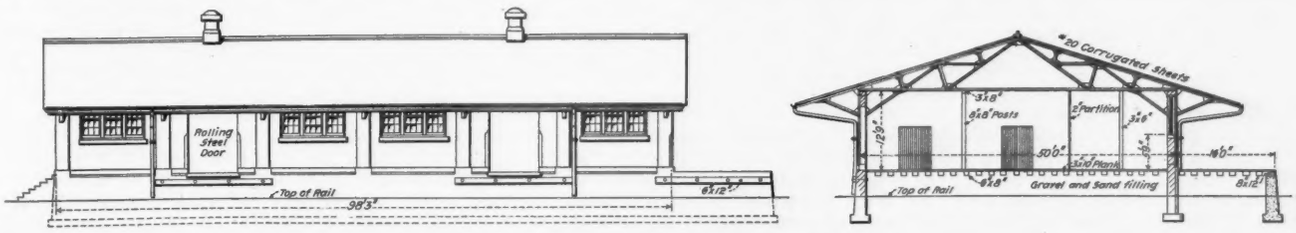
The entrance doors will be bronze, finished a dark copper color, and the marquees over the main entrance and side exits, as well as the ornamental roof cresting, will be of cast-iron, plated to match the color of the doors. The entire roof will be covered with a dark green slate, laid in design, while all hips and decks of the roof will be of copper.

At the north end of the two-story wing will be an overhead iron bridge. This starts at the curb line of West Third street, gaining by easy steps a height sufficient to pass over all trains, and terminates at West Fourth street. This is to be a public thoroughfare. In the center of the main facade, above the cornice, will be a clock with the face large enough to be seen for several blocks.

The interior walls of the general waiting room are divided into panels, with pilasters placed so as to receive the ribs for the vaulted ceiling above. At the line of the second floor a cornice of ornate design will run around the entire room. The ceilings and walls at all openings will be deeply paneled with enriched plaster moulding. A large ceiling light will fill the center panel of the ceiling for about two-thirds of the length of the room, terminating with rounded ends made of art glass. Above the cornice line, at each end of the room, will be artistically designed clocks set in positions to be seen easily from any part of the room. The base and wainscot of the general waiting room and connecting corridors will be of marble and scagliola, selected for color and tone, and in harmony with the color scheme throughout the general waiting room and corridor. This color scheme will also be used in all of the second story corridors and the observation corridor. On the second floor, the observation corridor in front of the building will have arched openings, and on the opposite side there will be windows filled with art glass, appropriately designed. All of the interior wood finish throughout the building will be in quarter-sawed oak, finished in keeping with the color scheme.

The building is to be fire-proof throughout—the exterior walls of brick and the interior columns, floor girders and the floors of reinforced concrete. All of the trusses supporting the roof will be of steel, and the entire concourse and train shed will be of steel, having the roof covered with asbestos roofing. The building is to cost about $450,000, and will be built from plans made in the office of J. H. Wallace, Assistant Chief Engineer of the Southern Pacific, under the direction of D. J. Patterson, Architect for that company.

Besides the new union station, the yards and terminal facilities

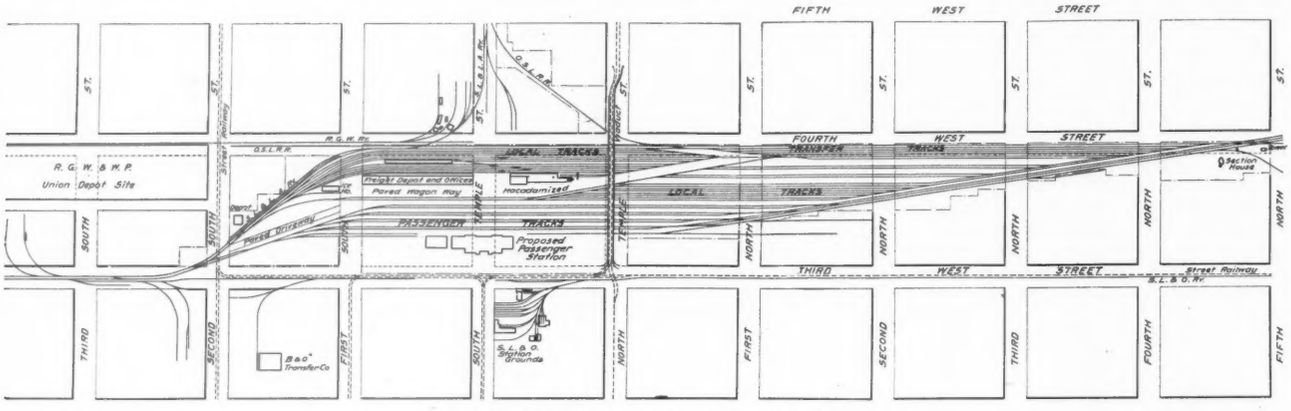


New Hide House at Salt Lake City; Harriman Lines.

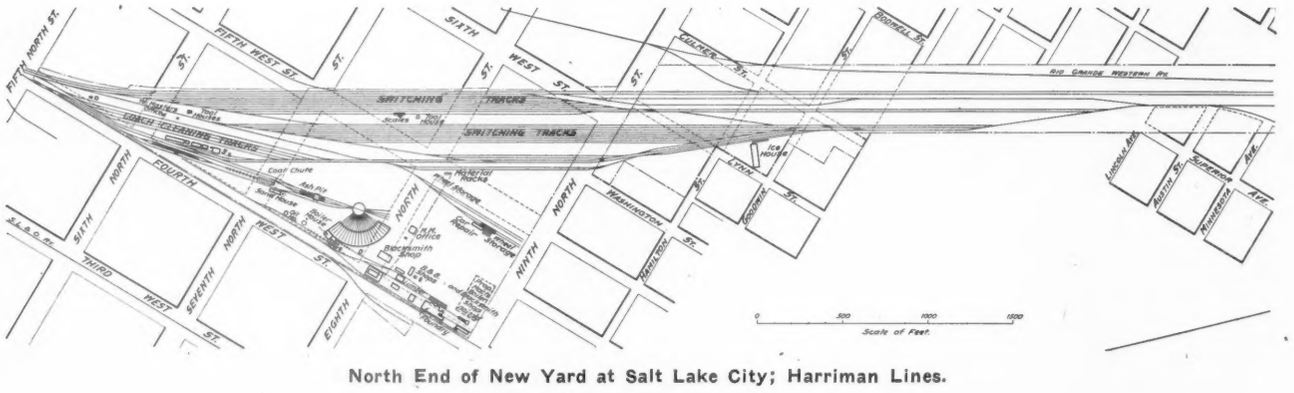
of the Harriman lines at Salt Lake City, are being rearranged and extended. This work is now nearly finished. More trackage and larger terminals were needed because of the great increase in freight and passenger traffic, due to the rapid growth of Salt Lake City and the development of the resources of the surrounding country, and also in part because of the building of the San Pedro, Los Angeles & Salt Lake, which uses the yards and terminal facilities of the Oregon Short Line at Salt Lake City.

As shown on the accompanying plan, the new terminal yards are composed of two parts, called the north yard and the south yard. In the north yard are the switching, repair, roundhouse, coaling and coach cleaning tracks, while the south yard contains the passenger station tracks, transfer and local freight tracks. All incoming freight trains are sent directly to the north yard, where distribution is made as required by car lading. All outbound trains are made up in this yard. Incoming passenger trains approach the passenger station from both north and south directly over main line tracks.

The combined yards when complete will contain in all 46.8 miles of track with room for 4,100 freight cars and 455 passenger coaches. The extreme length of the two yards is 2.98 miles and the area covered 134.27 acres, most of which was acquired for this purpose. The average gradient through the yards is about 0.3 per cent. The passenger tracks are laid with 80-lb. and the freight tracks with 70-lb. rails, with No. 7 and No. 9 frogs. All tracks connecting the north and south yards at Fifth North street are protected by an interlocking plant. The crossing of the Oregon Short Line and the main line of the Rio Grande Western on Ninth South and Fifth West streets is also protected by an interlocking plant. All switches except the ones controlled by these interlocking plants are operated by hand. The entire yards are ballasted with gravel and drain to the city's drainage system.



South End of New Salt Lake City Yard.



North End of New Yard at Salt Lake City; Harriman Lines.

Note change of angle in drawing.

The new terminal facilities in the north yard include an 85-ft., 20-stall brick engine house; a 600-ton coal chute with six pockets and cable hoist; a new foundry; car repair shops; store house; coach cleaning plant; Pullman linen house, and a new ice house of 3,000 tons capacity equipped with an electric elevator of the most improved type. In the south yards a freight house, hide house, ice house, transfer platform and heavy freight platform have been built.

As indicated by the accompanying plans, the freight house is of brick, concrete and steel construction. It is 660 ft. long by 50 ft. wide, with a platform 16 ft. wide running the full length of the building on the west, or track, side. The south 157 feet of the building is two stories high, the upper story occupied by the local freight offices. The remaining 503 feet, the freight shed proper, is one story. A basement 26 ft. x 50 ft. under the south end holds a hot water boiler and coal bins. The whole building is of fireproof construction, the floors are of reinforced concrete and the roof also of reinforced concrete with surface of tar and gravel roofing. The first floor, which is on the platform level, contains the cashier's office, hallway, warm room, refrigerator room and general freight room. The cashier's office is in the south end of the freight house, directly on First South street. A vault 5 ft. 11 in. by 6 ft. 4 in. is connected with the cashier's office. The warm room, 37 ft. by 40 ft., is arranged for heating and is used for storing such freight as would be damaged by frost or cold. The refrigerator room, 10 ft. by 24 ft., is used for general freight and is connected directly with the freight shed. Rolling steel doors are installed on both sides of the building. The second floor is occupied by the local freight offices, consisting of the agent's private office, 14 ft. by 25 ft.; general clerks' office, 98 ft. by 50 ft., and record room, 32 ft. by 50 ft., complete with steel shelving and steel tables for handling the records.

The freight shed proper is built entirely of steel. Rolling steel doors, 12 ft. by 10 ft., extend the full length of the shed on both sides, enabling any part or the whole shed to be thrown open. The building is lighted throughout by electricity, the wires being enclosed in iron conduits. In the freight shed arc lights about 40 ft. apart are used. The entire freight house, except the freight sher, is heated by hot water. The building was completed February 1, its total cost being $110,000.

The hide house is 50 ft. wide by 98 ft. long, and is of the same construction as the freight shed. It is used for handling green hides, beer kegs, junk, etc. It is divided in 12 compartments, each of which can be closed independently of the others. The total cost, including a 16-ft. platform on the west side, was $8,000.

North of the hide house and connected with it is the heavy transfer platform, 160 ft. long by 54 ft. wide at the south end and 30 ft. at the north end. A concrete retaining wall surrounds the entire platform. Three platform scales are provided, and at the north end there is a pillar crane of 10 tons capacity. The other transfer platform is west of the freight house and is 18 ft. wide by 400 ft. long. A corrugated iron roof covers the entire shed. The total cost of the two platforms was $7,600.

On North Temple street a solid reinforced concrete conduit was built by the railroad company across the whole width of its yards to carry the overflow from City Creek canyon. This conduit is 600 ft. long, with a sectional area of 3 ft. 9 in. by 10 ft. and a controlling gradient of about 1 per cent., while at its approach to the tracks the gradient is 6 per cent.

The North Temple street viaduct, as shown on the plan, spans

all of the Oregon Short Line tracks on North Temple street between Third West and Fourth West streets. It is a substantial steel structure of through plate girder construction supported by steel bents on concrete foundations. The length of the steel work is 916 ft. The east approach is 117 ft. long and the west approach 168 ft. long, making a total length of 1,201 ft. The minimum clearance over the tracks is 22 ft. The gradient on the east approach is 6 per cent., on the west approach 7 per cent., and on the viaduct 0.9 per cent. The floor is of wood and affords a clear roadway 24 ft. wide. On the south side a 6-ft. sidewalk is provided, which is reached by stairways at suitable points. The approaches to the viaduct are paved with stone blocks and are supported between concrete retaining walls ending in concrete abutments.

The total cost of these improvements, not including the new passenger station, will be about $1,000,000. We are indebted to W. H. Bancroft, General Manager of the Oregon Short Line, for the information. The plans for the freight and passenger yard were made in the office of William Ashton, Chief Engineer, under his personal supervision; likewise the plans for the freight house, which were prepared directly under J. P. Hill, Engineer of Buildings. The construction work was in charge of L. L. Dagron, Assistant Engineer.

June Railroad Law.

The following abstracts cover principal cases decided in June by the Federal courts:

Indictment under Elkins act.—An indictment under the anti-rebate act is not open to the objection that it sets out more than one offense, because it alleges that the defendant offered, granted and gave a rebate. United States vs. Delaware, Lackawanna & Western Railroad Co., 152 Fed. Rep. 269.

The Federal Employer's Liability Act.—Judge Hanford in the Circuit Court of Washington holds that the portion of the employer's liability act making interstate railroad companies liable for injuries, notwithstanding the contributory negligence of the employee, if the negligence of the railroad company was gross in comparison with that of the employee, is not unconstitutional as violating the commerce clause of the constitution. This statute revives the doctrine of comparative negligence—a doctrine discarded by practically every court in the United States. Plummer vs. Northern Pacific Railway Co., 152 Fed. Rep. 206.

Wilful injuries.—A railroad company cannot avail itself of the defense of contributory negligence on the part of a traveler run over and killed at a crossing if the fatal injuries were wilfully and wantonly inflicted. Lacey vs. Louisville & Nashville Railroad Co., 152 Fed. Rep. 134.

Care as to passengers boarding trains.—The rule that a train having stopped to discharge and take on passengers at a station must not be started while passengers are engaged in boarding the train, is available to one not having a ticket but intending to pay his fare on the train. St. Louis Southwestern Railway Co. vs. Wainwright, 152 Fed. Rep. 624.

Ejection of passengers.—A passenger refusing to produce a ticket or pay his fare may be removed from the train and the removal is not made wrongful because of a tender of the fare by a third person with the consent of the passenger after the process of the removal has begun. Missouri, Kansas & Texas Railway Co. vs. Smith, 152 Fed. Rep. 608.

Preferences.—An unlawful preference and discrimination is held to have been created by fixing the freight rates for common soap in less than carload lots in a new classification adopted to govern in official classification territory, at 20 per cent. less than third class, but not less than fourth class, at which that commodity has previously been rated, where the result of applying this classification to the varying rates, is to leave soap in less than carload lots in the fourth class to a considerable extent in one of the subdivisions of such classification territory and in a higher class in the other subdivisions. The Interstate Commerce Commission has the authority to order offending carriers to desist from the enforcement of such discriminations. Cincinnati, Hamilton & Dayton Railway Co. vs. Interstate Commerce Commision, 27 Sup. Ct. 648.

Transportation of liquors.—The agreement of a local express agent to hold for a few days a C. O. D. interstate shipment of intoxicating liquors at the request of the consignee to enable him to pay the charges does not destroy the interstate commerce character of the transaction and render the express company liable to prosecution for violating a state local option law. Adams Express Co. vs. Kentucky, 27 Sup. Ct. 606.

What is meant by "right of way."—Called upon to construe the meaning of the term "right of way" in a decree that one company should have the use of the "right of way" of another company, the Circuit Court of Appeals holds that the term when used to describe the real estate of a railroad company ordinarily signifies the entire strip of land which a railroad company has found it necessary or convenient to acquire for railroad purposes and is not limited to the specified part used for the main track or other particular purposes. St. Louis, Kansas City & Colorado Railroad Co. vs. Wabash Railroad Co., 152, Fed. Rep. 849.

Liability for fires.—The Circuit Court of Appeals of the Fourth District holds that where a fire was negligently set by a railroad company's sub-boss of a bridge and trestle crew while he was sleeping in one of the company's boarding cars when not on duty, his act was not performed within the line of his employment for the company, and hence it was not liable for property of other persons destroyed by the fire. Southern Railway Co. vs. Powers Fuel Co., 152 Fed. Rep. 917.

Condemnation of right of way for use of telegraph company.—A contract between a telegraph company and a railroad company giving the telegraph company an exclusive right of occupancy of its right of way is opposed to public policy and void, and does not prevent a condemnation of the right of way by another telegraph company. Georgia Railroad & Banking Co. vs. Atlantic Postal Telegraph Cable Co., 152 Fed. Rep. 991.

Automatic air-brakes.—A railroad company cannot be held liable for injuries, on the ground that it had not equipped its cars with air-brakes as commanded by statute, unless this violation of the statute was the proximate cause of the accident. Thus, where a pedestrian was killed on the right of way on stepping in front of a rapidly moving train without being seen by the engineer it is clear that the absence of the air-brakes was not responsible for the accident. Bookman vs. Seaboard Air Line Railway, 152 Fed. Rep. 686.

Labor unions.—Judge Cochrane, in the Federal District Court of Kentucky sustains the validity of the Federal statute punishing interstate railroads for discriminating against employees and persons seeking employment who belong to labor unions. He holds that such legislation is clearly within the interstate commerce clause of the constitution. United States vs. Adair, 152 Fed. Rep. 737.

Train Despatchers' Convention.

The twentieth annual meeting of the Train Despatchers' Association was held at Boston, June 18, 19 and 20. The attendance was large. The present membership of the association is 1,018, a net gain of 64 during the past year. The Treasurer's report showed the Association in good financial condition. The Train Despatchers' Bulletin, sent free to members, is to be increased by the addition of four pages, making 48 in all.

Discussing the report of the Train Rules Committee the association expressed belief that the "19" order is safe to be used for the superior as well as the inferior train in making meeting points provided the "middle order" be used in connection therewith. The delivery of this form of orders to the superior train contains an element of safety exceeding that of the "31" form inasmuch as the operator is on the platform for the purpose of delivering the order, and is in a position to prevent oversight of the signal.

It was recommended that a clearance card be delivered with all train orders, the card to show the number of each order, the intention being to give opportunity to conductor and engineman to check the orders with the card, thus making sure of the fact that none is overlooked. The card should be made in manifold, a copy for the conductor and each engineman (also the pilot, if there be one), the operator to retain the lowest copy.

The convention pronounced in favor of a signal to be placed on the engine of a train to denote "Schedule Fulfilled." Such a signal would be displayed on a single train if it were the only one using a schedule, or on the last of a number of sections if there were such. The present practice of displaying signals on all sections except the last is directly opposed to the foundation principle of signaling and contains an element of positive danger. No recommendatian was made as to the precise method, some members favoring a reversal of the present rule by requiring the only train on the schedule or the last section to display green signals, none being shown on the preceding sections, while others thought a distinctive signal shown on every train would more readily command the attention of those concerned.

Close to this subject is that of better means of identification of trains, the present practice being very imperfect, having caused a great amount of trouble in the past. Indicators showing the identity of each train, passenger and freight, were recommended.

The rules and usages of some roads make it important that conductor and engineman know positively when a telegraph office has been closed for meals or for the night, and it was recommended that there be some variation from the regular train order or block signal to indicate this condition.

It was recommended that a train register be used on single track at junction and terminal stations for the purpose of obtaining at first hand and in writing from the conductor of each train the information that the train has arrived, rather than from the observation of the operator. Whether this information be given to other trains by the operator or the despatcher, it should originate with and be recorded by the conductor of the train. It was

deemed that a matter of so great importance should be recognized and provided for by the Standard Code.

The "A. B. C." Rules devised by Mr. A. Beamer, Superintendent of the Northern Pacific, and used on a section of that road handling a heavy traffic, were discussed at length and with approval of the convention. Briefly stated the plan is this: All superiority between trains is eliminated, no trains orders are issued and a train leaving any station is given authority to run to the next station, and to the next only, regardless of all trains. The operators work the regular telegraph block system between themselves, and in addition the despatcher directs whether or not the train may proceed from the station. The only authority in the hands of conductor and engineman is a block card furnished by the operator under direction of the despatcher. The plan has been in satisfactory operation for several months. Train despatchers are convinced that the present system of train orders, although developed to a high standard of efficiency, is inadequate to the needs of the large traffic of to-day. The convention voted to continue consideration of the subject through its Train Rules Committee during the coming year.

The next place of meeting will be Fort Worth, Tex., and the incoming officers are as follows: President, C. H. Mullinix (Illinois Central), Fulton, Ky.; Vice-President, C. A. Mitchell (N. Y., N. H. & H.), Boston, Mass.; Secretary, J. F. Mackie (C., R. I. & P.), Chicago, Ill.

The Coal Reserves of the United States.*

Coal may be divided into three main classes—anthracite, bituminous and lignite, but in the trade these main classes are broken up into several groups, which are represented in the following diagram:

DIAGRAM SHOWING CLASS OF COAL.

Coal	Anthracite	(*a*) Anthracite.
		(*b*) Semi-anthracite.
		(*c*) Semi-bituminous.
	Bituminous	(*d*) Bituminous.
		(*e*) Sub-bituminous.
	Lignite	(*f*) Lignite.

(*a*) Anthracite coal is too well known to need description. (*b*) Semi-anthracite is a low grade of anthracite. (*c*) Semi-bituminous is a high grade of bituminous, such as the George's Creek coal of Maryland, Pocahontas coal of Virginia and West Virginia, and the Carboniferous coal of Arkansas. (*d*) Bituminous is the common grade of coal found throughout the eastern coal fields and in limited areas in the West. (*e*) Sub-bituminous is applied to coals below the grade of bituminous, but above that of lignite. They are black and shining, but are light in weight and slack badly on exposure to the atmosphere. These coals are common in the western fields of Washington, eastern part of Montana, northern Wyoming, about Denver in Colorado, and in northwestern New Mexico. (*f*) Lignite is brown and woody, and occurs in North Dakota, South Dakota, Texas, southeastern Arkansas, Mississippi and Alabama.

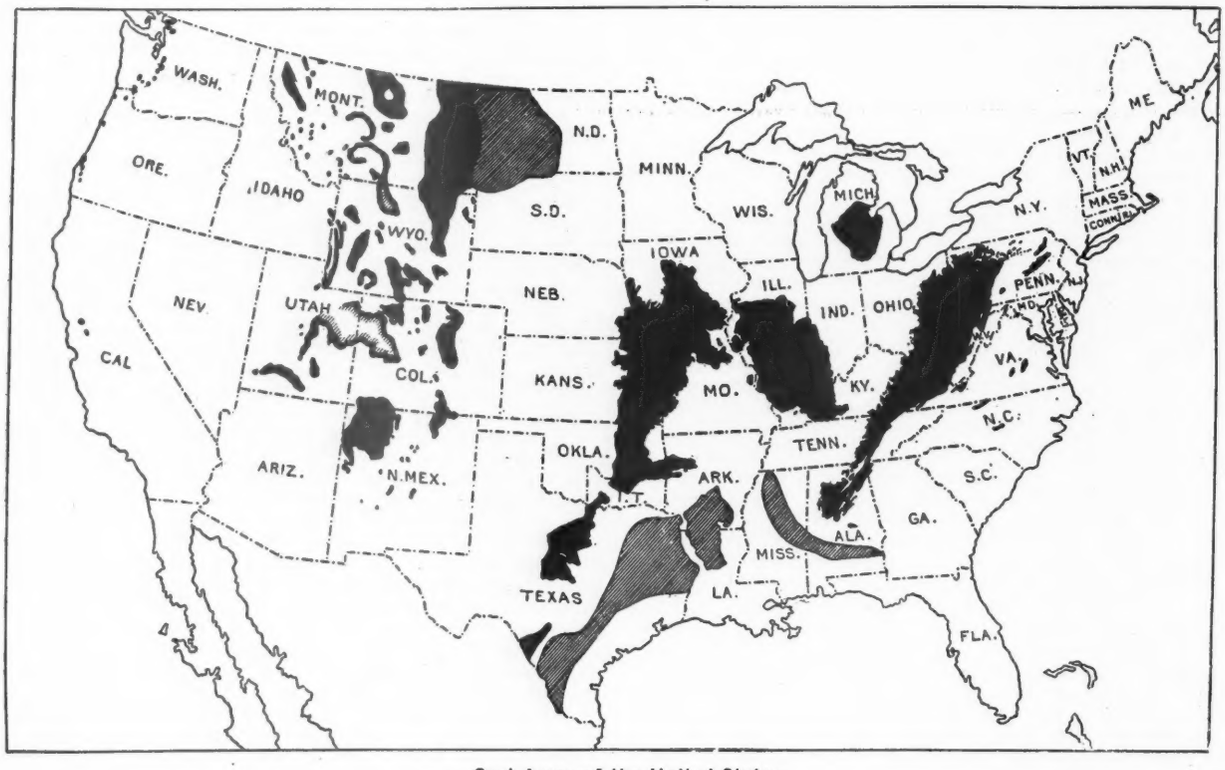
The classes noted above include all of the different kinds of coal that are known, but certain peculiarities of coals within the bituminous class have led to distinctions which are of great importance; thus the property of coking, which is limited entirely to the bituminous class, has given to coals possessing this peculiarity a value far above those coals having similar composition, but which do not possess this characteristic. The reason why one coal will coke and another will not is not understood; a practical test is the only way by which the coking properties of a coal are determined. Most of the coke is produced in the Appalachian coal field in Pennsylvania, West Virginia, Virginia, Tennessee and Alabama.

The coal output of the principal coal producing states for 1906 as reported by the United States Geological Survey was published in the *Railroad Gazette* of June 28, 1907.

The areas of the coal fields that lie within the various states differ greatly, even more than the production. The relative size of these areas is given in the accompanying diagram.

It will be a surprise to many to learn that the coal fields of Montana are more extensive than those of any other state, and that Texas is a close second. In this connection it must be understood that each of these states includes an enormous territory, equal to two or three of the smaller eastern states. It is true, however, that most of the coal territory of these states is underlain by low-grade lignite, and hence the fields are not so important as their areas would indicate. The same is true of North Dakota, which includes an extremely large area of coal territory, but the fuel is wholly lignite and of comparatively little value.

The extent of some of the coal fields is largely hypothetical. This is particularly the case with Washington, where the present estimate is probably far below the real extent of the fields. It might be supposed that Washington had been explored thoroughly enough to determine approximately the extent of its coal fields, but the peculiar conditions which prevail on the west slope of the Cascade range make it impossible to settle the question at the present time. The surface is deeply covered by glacial drift and vegetation, and it is only where the great streams, rushing down off the mountain slopes, have cut through this drift that the coal beds are exposed. In this way they are known at many localities, and it is probable that they are present in the intermediate covered areas, but no one is willing to say so until more prospecting has been done. When that occurs it is probable that the recognized area of the coal fields of Washington will be greatly increased. The known coal fields of Alaska seem to be comparatively small, having approxi-



Coal Areas of the United States.

Black shows anthracite and bituminous coal; shaded, lignite.

*Abstract of an address by Marius R. Campbell, of the United States Geological Survey, to the National Geographic Society.

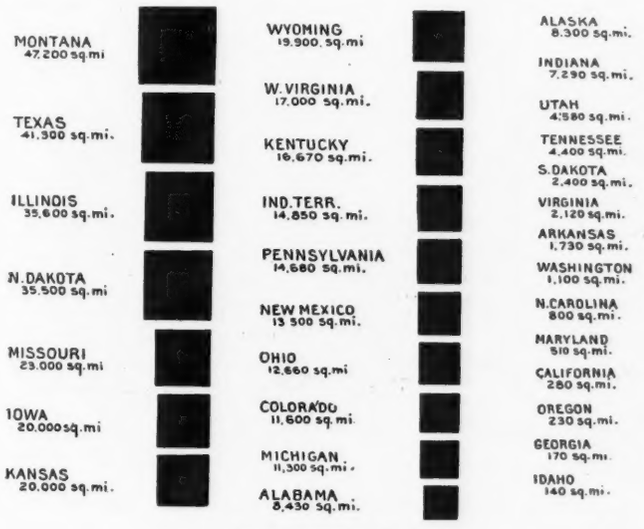
mately the same area as the bituminous field of Alabama. Here again exploration may, and probably will, increase the area materially, especially that of the low-grade lignites of the Arctic slope.

The area given for the coal fields of Alabama includes only the bituminous coal of carboniferous age in the northeast part of the state. In addition to this, as shown by the accompanying map, there is a wide band of lignite-bearing tertiary rocks crossing the southern part of the state. These rocks are known to contain beds of lignite, but in the presence of high-grade bituminous coal the lignite has never been explored, and consequently the number of beds, their thickness and extent, are not known. It is possible that when the supply of better fuel is exhausted, or has fallen below the demand, the lignite field may be found to contain an important supply of fuel.

So far as our present knowledge goes, the distribution of the various classes of coal in the western states is as follows:

Anthracite.—Only small areas of anthracite coal have been found in the western states and Alaska. Generally these are the direct result of volcanic activity and hence are of limited geographical extent.

The largest field of anthracite coal in the western states is in Gunnison county, Colorado, in the Crested Butte region. Apparently the anthracite in this field is the result of immense intrusions of igneous rock, which have baked the coal and thus driven off its volatile matter. The same coalbeds only a short distance away are either bituminous or sub-bituminous in character. One other occurrence of anthracite is known in Colorado, in the Yampa coal field, in the northern part of Routt county. In this locality the coal has been changed to anthracite by dikes and sheets of igneous rock. This field is very limited in extent.



Coal Reserves by States.

In New Mexico a small field of anthracite occurs near Cerrillos, on the Atchison, Topeka & Santa Fe. The field is small, and the anthracite is due to the baking effect of an intrusive sheet of igneous rock.

Utah claims a small field of anthracite coal in Iron county, near the southwestern corner of the state. It has not been developed and little is known of its extent or value.

In Washington a very small field of anthracite occurs in the vicinity of a large mass of igneous rock on Carbon river, southeast of Tacoma.

The largest anthracite field outside of Pennsylvania occurs near Controller bay, Alaska. In this field the change in the character of the coal is said to be not directly related to volcanic activity, but to be due to the intense folding to which the rocks have been subjected.

At present, anthracite is mined in the West only in Gunnison county, Colorado, and near Cerrillos, New Mexico.

Coking Coal.—Good coking coal is scarce in the Western fields. The principal source of supply is the Raton, or Trinidad, field, in southern Colorado and northern New Mexico. Of the coke produced in the western fields, 70 per cent. comes from this region. Some coke is also produced in Colorado, on the west side of the Front range, at Durango and in the vicinity of Glenwood Springs. Other important centers of coke production are Castle Gate and Sunnyside, in Utah, and along Carbon river southeast of Tacoma, Washington. Coke is also made to a limited extent in Wyoming near the Black Hills and in southern central Montana. There are several other coals that will coke with difficulty, which may be developed in the future, but the present prospect is not particularly promising.

Bituminous, Steam and Domestic Coal.—This class of fuel is much more abundant than either of the two preceding classes. In New Mexico the largest deposit of such coal is in the Raton field, in the north central part of the territory. Similar coal also occurs in the northern part of the great Durango-Gallup field, in the northwest corner of the territory, and in several small fields south of Santa Fe.

In Colorado good bituminous coal occurs in the fields just mentioned, at Trinidad and about Durango. It is also present in the small field south of Canyon City and in Gunnison county. As shown on the map, the latter field occupies the southeastern point of a large synclinal basin which extends as far west as Castle Gate, Utah. The coal outcrops on the south limb of this basin in the Book Cliffs west of Grand Junction and along the "Great Hogback" from Gunnison county northwestward through Glenwood Springs and Meeker. Throughout the whole line of outcrop around this basin the coals are of the bituminous class, although in places they belong to the lowest group of the class. Good bituminous coal also abounds in the Yampa field, in Routt county. Thus it will be seen that Colorado has a large supply of this class of coal.

Utah is also well supplied by the same basin and by its extension southward from Castle Gate along the Wasatch Plateau. There is also a small field at Coalville, east of Salt Lake City, and a field of unknown extent in Iron county, occupying the Colob plateau.

Wyoming has bituminous coals along the line of the Union Pacific at or near Hanna, Rawlins, Rock Springs, and Kemmerer, and also in small areas about the Black Hills. It is possible that other areas of bituminous coal exist in this state.

Montana has considerable bituminous coal in the fields along the Northern Pacific west of Billings, about Great Falls and in the Crazy mountains, but by far the largest areas in the state carry coal of an inferior grade.

Washington has several bituminous coal fields along the western foothills of the Cascade mountains and at least one local basin at Roslyn, on the eastern side.

Most of the coals of California are of low grade, but one bed has been developed in Stone canyon, in the southeast corner of Monterey county, that is good bituminous coal. So far as known, this is the only coal of this class in the state.

Sub-bituminous Coal.—This class of coal is abundant in the western fields. Most of the coal in the south part of the Durango-Gallup basin is of this class. It is the only coal found in the Denver basin and in North and South Parks of Colorado. The great fields in the northeastern part of Wyoming, the Bighorn basin, and most of the fields in Uinta county contain sub-bituminous coal. All of eastern Montana is supposed to be underlain by it, as is also the big field in the north-central part of the state around the Bearpaw mountains. A number of small fields lying west of Butte, Helena, and the main front range contain coal of this character, but generally they are of small extent and probably have little commercial value. In Washington this class of coal is abundant, but as a rule it occurs some distance west of the Cascade mountains.

Lignite.—This class of fuel is found only in the fields of southern Alabama, Mississippi, Arkansas and Texas on the Gulf slope and North and South Dakota at the north. It is mined commercially only in North Dakota and Texas.

Up to the present time we have used our fuel without question as to possibility of its exhaustion. Of late, however, more far-seeing people have been thinking deeply on this subject, especially since the recent order of the President withdrawing temporarily from coal entry 64,000,000 acres of coal land, and his recommendation to Congress that the time has arrived to begin the conservation of our mineral fuels, and urging upon that body the passage of laws upon the subject.

In the older fields of the east, with the exception of Indian Territory, practically all of the coal land has passed to private ownership. Therefore the President's order and the interest of the people generally, centers about the coal fields of the Rocky Mountain region and the Pacific slope. The former contains an area estimated at 134,800 square miles, and the latter, including Alaska, 10,000 square miles, or a total of 144,800 square miles out of a total for the whole country of 400,500 square miles.

Of this area of 144,800 square miles of coal fields of the western states, it is estimated that 50 per cent. has passed to private ownership, leaving about 72,000 square miles of coal fields yet belonging to the government. It must be remembered, however, that more than half of this area is included in the lignite fields of eastern Montana, North Dakota and South Dakota, and when this is deducted from the figures given above, it leaves an area of only about 33,000 square miles of fairly good coal, the title to which is still vested in the United States.

The estimated amount of coal in the coal fields of the United States, not including Alaska, is 2,200,000,000,000 short tons, enough,

if it were moulded into a block, to form a cube with a side 7½ miles long, or spread out flat to make a layer 6½ ft. thick over the 400,000 square miles of coal fields of the United States. Is not this amount, to all intents and purposes, inexhaustible? In order to judge about this, it is necessary to know the rate of consumption.

The total production of the United States in 1906 was over 414,000,000 short tons. The United States leads the world in coal production by over 100,000,000 tons, Great Britain, and next Germany, being the only countries which produce more than about 50,000,000 tons a year. If the present rate of coal consumption should be maintained from now on, the coal of the United States would last nearly 4,000 years. On the other hand, the increasing rate of coal consumption in the United States is an alarming factor in considering the future supply. The rate of increase is enormous, the amount produced in each decade since 1816 being equal to the entire previous consumption. The amount of coal consumed in the 10 years from 1816 to 1825 was about 315,356 short tons. In the 10 years from 1896 to 1905 the consumption was over 2,832,599,452 short tons. If the consumption of coal continues to increase in the future as fast as it has during the last 90 years, the coal supplies of the United States will be exhausted in about 100 years. Since there is every prospect of a constantly increasing demand for coal, it seems probable that the rate of consumption will increase at nearly the same ratio as in the past, and hence that the life of the coal fields of the United States will probably be about 200 years.

New Southern Pacific Passenger Station at Tucson, Ariz.

The accompanying illustration shows the general style of a new passenger station which is just about to be opened for use by the Southern Pacific at Tucson, Ariz., a division point on its main line from San Francisco to El Paso and New Orleans. This is one of the first adaptations of the old Spanish mission architecture to a Southern Pacific passenger station. The building is arranged not only to accommodate the traveling public, but also the division officers and staff.

New Passenger Station at Tucson, Ariz.; Southern Pacific.

Southern Arizona is very hot during most of the year, therefore the building was so planned that the waiting rooms on the ground floor are protected from the sun's rays by wide arcades on each side of the main part of the building. The main building is flanked at each end by a low one-story wing. Each end of the main building itself on the street front shown in the photograph has a shallow pavilion. Similarly the track side of the station has a gable. At each end of the main building, which is two stories high, is a low one-story wing. The building is 218 ft. by 60 ft., with solid brick walls, finished outside in cement stucco. The ornamentation is of cast cement stone placed in the walls during construction. Level with the second floor is a low, deep loggia covered with a wide sweeping roof of red terra cotta Spanish tile.

The foundation and basement floor containing a heating plant is built of concrete. The second floor and roof timbers are wood. In the center of the main building on the first floor is the ticket office, with the general waiting room and women's room on one side and the smoking room and waiting room for Mexicans on the other side. The baggage room is in the smaller one-story wing at the end of the main building. In the wing at the other end is an emergency hospital and the offices of the commercial agent and roadmaster. The whole second floor is to be used by the division force.

The interior of the building is in keeping with the style of the exterior. The walls of the smoking room are paneled up to the height of the doors with wood; above this a low, ornamental cornice runs around the whole room. The frieze between this cornice and the ceiling is filled in with a dark leather, in the center of each panel of which is a shield, representing in colors the great seal of one of the states through which the Sunset Route of the Southern Pacific runs. In the entrance vestibule are four Tympanum arches, which are to be filled with oil paintings by Maynard Dixon of subjects typical of Arizona or taken from its history. The general waiting room and smoking room will have tile floors. There are especially designed electroliers for lighting the building which is equipped throughout with electric fans and steam heating. The cost of the new station is about $65,000. The plans were made in the office of J. H. Wallace, Assistant Chief Engineer of the Southern Pacific, by D. J. Patterson, Architect for the company.

Association of Transportation and Car Accounting Officers.

The semi-annual meeting of this association was held at St. Paul June 25 and 26. The principal reports were printed in the *Railroad Gazette* of June 28, page 923.

The membership of the association now represents 215,000 miles of road. The committees on per diem and on car service were consolidated and a new committee on "Conducting Passenger Transportation" was created. This committee proposes to consider the advisability of restricting baggage to certain trains (in suburban service), the effect of electrification on passenger business, standard speeds of trains for different degrees of curvatures, and using half-minutes in reporting trains.

The committee recommendation concerning Per Diem Rule No. 5 was recommitted. The report on office methods was adopted substantially as presented. The report of the committee on conducting transportation brought out a long discussion, the views of the committee being very generally approved.

The rules for handling cars, recommended by the committee on car service, were adopted, with the exception of Rules 9, 10 and 17, which were recommitted.

The next meeting will be held at Chicago, December 10, and the next summer meeting will be held at Atlantic City June 23, 1908. The President of the association for the ensuing year is Fred Clark (C., B. & Q.), Chicago; Secretary, G. P. Conard, 24 Park Place, New York City.

Standard Time on the Canadian Pacific.

Mr. W. J. Camp, Electrical Engineer of the Telegraph Department of the Canadian Pacific Railway, read a paper on this subject at the annual meeting of the railroad telegraph superintendents at Atlantic City. The circuits of this road being very long, time signals are sent by hand. The speaker describes the arrangements of the repeaters at Montreal, where the time is taken from McGill University. The company sends time regularly to islands in the Pacific ocean, also to the Azores, in the Atlantic, and other distant points. The true longitude of Montreal was fixed several years ago by a long series of observations by astronomers at Montreal and in Nova Scotia, Ireland and England. Mr. Camp says that on several occasions the time given on railroad lines in the United States has been as much as three seconds in error. The standard clocks on the Canadian Pacific are made the subject of daily records, and the reports are examined and compared every month. The time inspector visits every standard clock once, twice or thrice a year. The watch inspectors of the company examine every watch twice a year, and all watches are twice a month brought to them to be compared. An employee who has neglected to visit the inspector in the first and third weeks of each month is not eligible for duty without an order from the superintendent. Each employee must keep with him the card showing the rating of his watch. All watches must be cleaned at least once in 15 months. All inspectors have seconds pendulum clocks and are required to ascertain the error thereof at least once a day. At Montreal the Canadian Pacific has 81 clocks on five circuits worked by one master clock.

Five More New York Public Service Commissioners.

Last week we published the photographs of four of the members of the New York Public Service Commissions. The accompanying photographs are of five more Commissioners; of these, Mr. Keep is a member of the Commission for the Second district, consisting of all New York state except New York, Kings, Queens and Richmond counties. The other four are on the Commission for the First district.

Charles H. Keep, of Buffalo, was born in Lockport, N. Y., in 1861. He graduated from Harvard University in 1882, and from Harvard Law School in 1885. He practiced law in Buffalo until 1903. From 1890 to 1901 he was Secretary of the Lake Carriers' Association, and from 1898 to 1901 was Secretary of the Buffalo Chamber of Commerce. In 1903 he was appointed Assistant Secretary of the United States Treasury, where he remained until January, 1907, when he was appointed Superintendent of Banks of New York state.

C. H. Keep.

William McCarroll, of Brooklyn, was born in Belfast, Ireland, in 1851. He was educated at Russell's Academy, Brookville Academy and at the Royal Academical Institution and then came to this country, where, in 1869, he began to work in the leather manufacturing business. In 1878 he formed a company of his own and in 1902, when the American Leather Company was organized, he was made Vice-President and General Manager. He is now President of this company and also President of the Hide and Leather Association, the New York Board of Trade and Transportation and the Morocco Manufacturers' National Association. Mr. McCarroll is also Chairman of the National Committee for the Promotion of Foreign Commerce and a Director of the National Manufacturers' Association, as well as being a member of several other organizations.

William McCarroll.

M. R. Maltbie.

E. M. Bassett.

Edward M. Bassett, of Brooklyn, was born in that city in 1863. He was educated at Hamilton College, Amherst College and Columbia Law School. After graduating from the latter he was admitted to the bar in 1886. He spent the next six years in legal work connected with a contracting firm in Buffalo, and then returned to New York and began the general practice of law. He is now the senior member of the firm of Bassett, Thompson & Gilpatrick. He was on the Brooklyn Board of Education from 1889 to 1901, and on the Flatbush Local School Board from 1901 to 1902, when he was elected to the United States Congress, where he served for two years. Mr. Bassett has worked on the improvement of the United States bankruptcy law and the New York state law regarding eminent domain.

J. E. Eustis.

Milo R. Maltbie, of New York, was born at Hinckley, Ill., in 1871. He graduated from the Upper Iowa University in 1892, from the Northwestern University the next year, and from Columbia University in 1897, after having acted as Professor of Economics and Mathematics at Mount Morris College from 1893 to 1895, and as a fellow in administrative law at Columbia from 1895 to 1897. He was Secretary of the Reform Club Committee on municipal affairs from 1897 to 1902, during which time he was also Editor of *Municipal Affairs*. He was prize lecturer on municipal government at Columbia in 1900, and has been Secretary of the Municipal Art Commission since 1902. Mr. Maltbie has been on several other commissions; he has investigated civic art and municipal conditions in Europe, and has also investigated the municipal ownership of public utilities in Great Britain, the street railway franchises of Chicago, and the Ramapo water contract in New York City.

John E. Eustis, of the Bronx, was born in Limerick, N. Y. When he was 17 years old, he enlisted in the 20th New York Cavalry, in which he served for two years, and then went to Wesleyan University, where he graduated in 1874, having taken a scientific course. He then came to New York and was appointed City Surveyor. The next year he began to study law and graduated from Dwight Law School in 1877. In 1880 he began practice and is now a member of the firm of Eustis & Foster. He served as School Trustee of the Twenty-fourth Ward until 1885 and was then made a School Inspector, which position he held for five years. In 1896, he was appointed Commissioner of the Board of Education. He was Park Commissioner for the Bronx in 1902, and he has been Vice-President of the Citizens' Union, and a member of its City Committee, of the Bronx West Side Association, of the Civic League, of the West Side Board of Trade, of the Bronx Bar Association, and of the Bar Association of New York county.

Electric Railways.*

SUBJECT FOR DISCUSSION:

(*a*) What are the factors which determine the maximum economical grade for electric railways?

(*b*) In establishing direct lines with heavy grades, under what conditions will it be found practicable to use electric locomotives and gas-engine generating stations, rather than traction by steam locomotives?

It is difficult to furnish material for discussion of a question having such scope as the first part of this topic, except in the shape of generalities, which are either obvious or of little use in the special case which the engineer may have in mind. The length of line, the character and density of traffic, the location and length of grades, all have important bearings upon the economies, constructing and operating, in any railway proposition. It is probable, therefore, that the proposer of the question had in mind a discussion of the factors peculiar to the method of traction, rather than those effecting the location of rail-

*An informal discussion at the annual convention of the American Society of Civil Engineers, by George Gibbs. From advance pages of the *Proceedings* for August, 1907.

way lines in general. These factors result from the method of application of the power to the trains and from the interconnected character of the apparatus which makes up the motive power system.

On a steam railroad the power plants are the locomotives; an electric road has its power system jointly in the locomotives (or the motor cars), in the continuous power conductor along the line, and in the central power-house. In the steam railroad, therefore, the first cost of power equipment is fixed by the number of locomotives, independently of the location, or the length of line, or other outside considerations; with the electric proposition the first cost of the power system is affected, not only by the number of locomotives or motor cars, but also by the magnitude of the other items of power equipment, and these items depend largely upon the grades, their length and possibly their position. For instance, we can readily imagine a line with grades located in such a way that, with a given train interval, all trains may be ascending simultaneously; in such a case the line equipment and power-houses must be designed to supply all trains taking power simultaneously, even if this maximum power is only needed for a small percentage of the total time. A location with the grades differently selected, even if the maximum gradient is not altered, might readily result in a much lower maximum demand at the power-house, and a consequent reduction in cost of the power system. Length and position, as well as rate of grades, therefore, are of much importance in an electric railway proposition.

The quantitative importance of these factors, of course, depends upon the character of the business; thus, where the traffic is very dense, requiring the operation of trains at short intervals, the relative location of grades is not as important as with infrequent train units, because, as the number of trains is increased, those ascending and descending the grades at any one time tend to balance, resulting in a relatively steady load on the power-house. The length of grade in an electric proposition has a peculiar importance because of the fact that electric motors have a rating in which the time limit comes in. Thus, for short maximum grades, the limit of motor capacity is in the commutation of the current; with long grades the limit is in the heating of the motors, due to the cumulative effect of passing current through the motors, the resulting heat being not entirely dissipated by radiation.

As to maximum practicable gradients. This factor is generally a less limiting one in electric traction than in steam. For trains composed in whole or in part of motor cars, the question of adhesion may generally be dismissed, because the limiting grade, from the standpoint of safety, is generally less than that dictated by the adhesive limit. Even with locomotive trains the problem is less serious in electric than in steam traction, because of the large proportion of the electric locomotive weight available for adhesion, and because of the facility with which trains may be double-headed with electric locomotives. This arises from the fact that by multiple control two or more locomotives become in effect a single unit, and are not open to the objections of dual control, as in operating two or more steam locomotives on one train.

From the two factors, namely, the higher adhesion ratio and the selection of grade locations, it may result that, with an electric railway line, the economic grade may be greater than that possible with steam traction. For certain kinds of electric railways in a flat country, for instance the interurban trolley road, this facility for surmounting short but very heavy grades without reaching the adhesive limit is of great importance in separating steam and electric grades at crossings, without excessive cost, either for grading or for power plant.

The effect of gradient upon operating cost cannot well be discussed for the general case; in some cases the grades may have little or no effect, if they are short and the traffic is heavy; in other cases their length and location may have an important effect upon the quantity of fuel required and the economy of power-house operation. Of course, the cheaper the fuel the less the importance of this factor in determining the line location.

Summing up, therefore, some important points to be considered in laying out an electric traction proposition are:

1. The effect of density of traffic in averaging the load requirements at the power-house.

2. The effect of location of grades, especially in infrequent service, in averaging load requirements at the power-house.

3. The wider latitude in fixing the maximum grades because of the greater adhesion ratio.

4. Limiting commutating effects on short grades.

5. The motor heating effects on long grades.

6. The less effect of grades on speeds because of the greater accelerating rate possible.

In order to use gas-engine stations successfully for any electric traction project it is necessary, of course, first, that gas engines and generators be obtainable of the proper characteristics for such work, and, second, that they will prove advantageous and economical. The form of the question appears to limit the subject to gas-engine prime movers for electric lines, rather than consideration of electric traction versus steam traction. In laying out the project in question, however, it is presumed that it would first be essential to determine whether electric traction of any kind would be advantageous, and then whether gas engine would be better than steam or water-power prime movers.

A general discussion of electric versus steam traction, of course, opens up a vast subject, and to indicate even the treatment would be beyond the limits of a brief opening discussion. Generally stated, for heavy grade work it may often be advantageous to adopt electric traction, not only because of economy of operation, but because of an increase in the capacity of the line consequent upon the use of exceptionally powerful electric locomotives which will enable the ruling loads to be taken over the grade without doubling; also because of the convenient application and control of electric locomotives, and because of the factors mentioned in connection with the discussion of the previous question.

Having determined that it will be economical or advantageous to use electric traction, it does not necessarily follow that gas engines would be the best means for producing power. Where water-power is available, and may be developed at moderate cost, on the line or within reasonable transmission distance of it, it will be found that such power will be more economical than either gas or steam. Where water-power is ruled out, and where the railroad is located within a short distance of coal mines, it may be that a steam generating station would be more economical than a gas-engine station, because of the lower first cost of the steam generating plant.

In order that the gas-engine plant may be used economically, it is necessary that, as before stated, the machinery be available in units of proper size, that the details be worked out practically, and that they compare favorably with steam or water in first and operating costs. Doubtless these questions will be discussed in connection with the subject of gas engines, and, therefore, it may be stated here, that, from the point of view of economy of power, the gas-engine plant promises well, but from the view of availability there appear to be at the present time two important limitations: The first is in the small over-load capacity of the gas engine, which is disadvantageous for fluctuating railroad loads, and the second is in the fact that gas engines and producer plants, up to this time, have been developed in relatively small units. Of course, it is true that some large gas engines have been built, but they can hardly be called a commercial article yet for general application to railway purposes.

The Railroads of Mexico.*

BY ERDIS G. ROBINSON, C. E.
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The national history of the Republic of Mexico is of such surpassing interest that one writing only of the railroads of that country can with difficulty confine his thoughts, and therefore his pen, strictly to his subject. The temptation to wander is strong and ever present. If at times the following remarks may seem to depart somewhat from the stated subject, the writer would suggest, in addition to the above, that in making a study of railroads it is necessary to a proper understanding of the subject to know somewhat about the physical character of the country served, as well as its commercial activity and political stability, since the prosperity of the one is dependent upon that of the other.

Soon after the conquest in 1520 by that intrepid explorer and courageous adventurer Cortes, Mexico became the source of much traffic in precious metal exportation. The Spanish conqueror and explorer was most keen after the riches of the earth and but little concerned with the welfare of the people or the future of the country he was despoiling; wherein, we are led to believe by certain radical sheets of to-day, he resembled greatly the commercial *conquistadores* of the present age. Those early prospectors covered the entire land; mineral deposits were discovered and worked by slave labor, and the precious metals mined were sent to Spain in vast quantities. For the transportation of these precious cargoes from the interior to the seaport at Vera Cruz, roads and trails were built with a thoroughness attested by the present use of many of them still in good condition.

But a nation conceived in greed and selfishness, and nurtured in tyranny and injustice cannot become the home of a peaceful people and prosperous enterprise. For 300 years the seeds of discord sown by the early Spanish colonizer, though lying dormant during certain long periods, finally harvested crops of internal rebellion and foreign invasion which prevented the country during all that time from enjoying the real prosperity which comes only with national peace. It was not until the present ruler of Mexico, by means of a successful revolution, established himself as president of the republic, that an era of peace was inaugurated which promised to endure. This happy condition made possible the development of

*When it is necessary to refer to values or costs the writer has used the words *dollar* and *cent* to refer only to the money of the United States. When values are given in Mexican units, the words *peso* and *centavo* are used. This course is not only the proper one, but seems to lead to less confusion than to be referring frequently to "*dollar, Mexican currency*," or "*dollar, gold*," or "*dollar, United States currency*," etc., as is often done. It is easy to remember that the Mexican peso has a fixed gold value, and is worth 50 cents.

the railroad interests, which forms the greatest guaranty of the continuation of peace and prosperity, since it furnishes employment for the people, facilitates the operation of other industries and strengthens the hold of the government upon all the districts of the state.

Accordingly, with peace thus established, the natural riches of the country and the special inducements offered by a wise government attracted the alert mind and opened the pocket of the far-seeing investor, and the final foreign invasion of Mexico was begun by the commercial conquest and the inauguration of the railroad era.

RESOURCES.

It is to be expected that a country with a great variety of climatic conditions will have a very diversified production. From the tropical and humid coast lands of Mexico to its high, cool and dry plateau may be found nearly all of the possible weather conditions, and the products vary accordingly. The plains of the temperate plateau are naturally dry and therefore unproductive. These areas are largely covered by extensive mesquite growth, very valuable as sources of fuel, as well as many varieties of the not invaluable cactus. In some favored localities where nature has provided springs or running streams beautiful garden spots are found, where fruits, grains and vegetables are grown in abundance. The Mexicans, urged by necessity, have developed a high order of skill as hydraulic engineers, and have in successful operation many irrigating plants led from the reservoirs located in the hills. At the advantageous physical positions on the plains and in the mountains are located towns and haciendas which become the centers of much business. Near Torreon are large areas planted in cotton, the yield of which is all fabricated in the country. Further to the north are found some of the largest cattle ranges in the world. To the northeast, on the line of the Mexican International, are located the only considerable coal fields of Mexico. Further to the south, in and around Mexico City, as well in other centers of population, are large tracts planted with maguey, from which is produced the prodigious amount of intoxicating liquor consumed in the country, this traffic amounting to nearly one-half of the total agricultural tonnage of the Mexican Railway. From the different districts over the country come many important crops, nearly all of which are consumed at home. In Monterey there has recently been finished a high-grade steel plant; in several cities there are smelters for reducing the vast amounts of ore mined in the country, and in other cities miscellaneous industries are located. All these industries are carefully fostered and guarded by a high protective tariff law, the good effect of which on the internal development of the nation is plainly evident.

In the mountainous regions there are many large tracts of fine timber land of almost untold value to the country at large, and to the railroads in particular, as sources of construction timber and fuel. Many miles of roads have been built to exploit these rich timber lands.

On the lower coast lands are grown the usual tropical and semi-tropical crops—rubber, tobacco, henequin, cane, coffee, chicle, etc., as well as crops found further north.

In naming the resources of Mexico as the basis of its railroad industry, the mining business must be given the greatest prominence. The history of Mexico is a story of its mineral development. With the discovery and opening of the mines came cities located near those centers of wealth. As time passed mining methods improved; the cities grew, railroads were necessary, and engineers were given the task of reaching by rail these cities which had been located with no thought of future rail connections. Later, as the mining business prospered, all other lines of industry increased in proportion. It became necessary to communicate with the outside world and railroads to the seaports were needed.

The important relation of the mineral resources to the railroad business can be no better shown than by studying the table giving classification of the railroad traffic (shown elsewhere), from which it will be noted that the products of mines make up 54 per cent. of the tonnage of the Mexican Central, 75 per cent. of that of the Mexican International, 46 per cent. of that of the Mexican National and 26 per cent. of that of the Mexican Railway. Expressed in round numbers and in the Mexican peso, the gold mines yield annually 22 million, the silver mines 80 million and the copper mines 25 million. The entire exports of the country amount to something over 200 million pesos, the imports to 160 million pesos and the corn crop to 75 million pesos.

TOPOGRAPHY.

A large part of the area of Mexico is a high tableland, with considerable width at the northern part and narrowing to a point south of the City of Mexico, where the mountain ranges converge. Across the northern part, along the United States boundary, the elevation is between 2,000 and 4,000 ft., and at the city, 7,500 ft. This rise in elevation is not made gradually, however, but over a series of plateaus separated from one another by intervening ranges of hills. At Torreon, about midway from the northern line to the City of Mexico, the elevation is almost the same as at El Paso, although the separating ridges passed over have reached an elevation of 5,000 ft. on the north and over 8,000 ft. on the south of that centrally located city.

Along each coast line is a strip of low land less than 100 miles wide, which has the good and bad qualities common to the truly tropical climates. At the least unfavorable points along these coasts are seaports, some located at natural harbors formed at the rivers' mouths, and some built up on the open coast line. Tampico is of the former and Vera Cruz of the latter class, for nature has not blessed Mexico with numerous and well-sheltered natural harbors, and in securing those in service the government and the railroads have had to help. At Tampico an excellent harbor is secured by means of jetties at the mouth of one of Mexico's large rivers, these jetties forming as fine an example of such construction as will be found in any country. They were built for the Mexican Government by the Mexican Central, E. L. Corthell being the consulting engineer. The deep water assured by these jetties and the excellent wharves recently completed by the government at a cost of nearly 4,000,000 pesos, as well as other wharves, and the connection by rail to Mexico City and to Monterey by two lines of the Mexican Central, may well account for the large tonnage handled at this port. At Vera Cruz, until recently, there was no good harbor protection nor wharf facilities for handling of the cargoes, which were transferred to land by lighters from the vessels anchored in the open. This city, however, had been the principal seaport since the time of the Spanish conquest. The vast quantities of precious metals in transit to Spain were brought here for shipment, and the importance of the port was thus early established, and it still ranks first in importance in value of imports and exports. Two lines of railroad now connect it with the Mexico City, and it also has connection with the Isthmus of Tehuantepec, on the south. The importance of this port gradually made better harbor protection imperative, and this was secured by great breakwater construction, which has resulted in a sufficient depth of water and a well-protected anchorage.

There are a number of harbors along the Pacific coast, notably at Acapulco, Manzanillo, Mazatlan and Guaymas. These harbors are as yet without rail connection with the interior of the country, although, prompted by prospects of good business and by liberal government subsidies, many lines have been projected and surveys made. At the present time the Mexican Central is completing its line from Guadalajara to Manzanillo (to be described later), at which point the government has recently made very important and costly harbor improvements.

The harbors named above, as well as others of less importance, have long accommodated a valuable coastwise trade, serving as natural outlets for the products of the low coast lands, but largely barred from handling the business of the interior until railroads were built crossing the two mountain barriers which, rising abruptly from the low elevations, divide these strips of coast lands from the great plateau areas. Almost from the level of the sea the mountains rise to heights which easily rank them with the loftiest ranges on this continent and furnish scenery of surpassing grandeur. In the eastern range, and in direct line from Vera Cruz to the City of Mexico, is Mt. Orizaba, rising from almost the sea level in one grand cone to an elevation of over 17,000 ft. Slightly southeast of the City of Mexico and plainly visible from it as beautiful snow-capped peaks are the two mountains, Popocatepetl and Ixtaccihuatl, the former rising to a height about the same as Orizaba. Further to the west, in the beautiful state of Michoacan and surrounded by vast areas of dense forests, is Mt. Patamban (elevation 13,000 ft.), while still farther west is the mountain of Colima. All these mountains are volcanic peaks; Orizaba and Popocatepetl were reported in eruption at the time of the Spanish conquest, while Colima is still doing business as a volcano, its frequent eruptions of ashes and lava being an unique and grand spectacle which furnishes a good bid for tourist travel in the hands of the passenger agents of the Mexican Central, whose Pacific extension skirts the base of this interesting mountain. The mention of these few mountains will serve to indicate the general character of the ranges separating the low from the high lands; lofty volcanic peaks with all the rugged topography that can accompany such mountains.

In order to exploit the mineral and timber riches of these lands, and to convey to and from the seaports the products and supplies of the engineer, as well as the faith and confidence of the capitalist. necessary to cross by railroads these forbidding mountain areas and to penetrate into their very hearts. The slopes and passes among these mountains are deeply cut by barrancas of most forbidding topography, which while they offer the only means of crossing, still seem to have been designed by nature to test the patience and skill of the engineer, as well as the faith and confidence of the capitalist. These barrancas are too wide and deep to be bridged and too sharply cut by tributary barrancas to be easily turned, and therefore must be overcome by heroic means.

To an engineer the nature of this country can be appreciated best by a study of the character of the lines already built. In a later paragraph will be given such information as the writer has been able to gather concerning the grades, curves, etc., of the lines that have been completed over these precipitous divides.

(To be continued).

Progress of the Pennsylvania Tunnels Under Manhattan Island.

In our issue of November 2, 1906, through the courtesy of the Pennsylvania, New York & Long Island Railroad and The United Engineering & Contracting Company, contractors for the work, we gave a general description of the plant and organization used in driving the Manhattan crosstown tunnels of the Pennsylvania extension into Manhattan and Long Island, being that portion of the line under 32d and 33d streets, between the east end of the terminal station at Seventh avenue and the East river, where the contractors are using the west half of the shafts sunk by S. Pearson & Son, who have the contract for driving the sub-aqueous tunnels eastward under the East river.

The plans for the tunnels under 32d and 33d streets, as originally made, showed three tracks from the terminal station to the west building line of Fifth avenue under each street, the third, or center track, to be used for storage purposes. The grade of the tunnel through this length was therefore made such that trains would remain at rest without setting the brakes.

From the west building line of Fifth avenue eastward the tunnels were designed for two tracks; those under 32d street for eastbound express and local use; those under 33d street for westbound service, and the grade was made 1½ per cent., descending to the level of the tubes below the bed of the East river. Under Fifth avenue and somewhat to the eastward these two grades were joined by a long, easy vertical curve.

The profile of the tunnels showed the base of rail an average of 85 ft. below the surface of the streets, and the accurate preliminary survey of the top of rock indicated that the roof of the tunnel, practically throughout its entire length, would lie 40 ft. below the surface of the rock.

On the west side of Fifth avenue, however, the bores passed under the bed of an old stream, flowing, in general, in a southeasterly direction through a trough of rock that was either the reason for its presence, or cut out by the action of the stream; and at this point the roof of the three-track section cut through the rock into soft material.

When this point was reached with the excavation going westward, the section was advanced by driving three separate small headings, one at the elevation of the roof in the middle of the cross-section and the other two the full height of the perpendicular sides of the tunnels.

Had the ground been dry, as had been expected, because of the elimination of surface water by buildings and pavements, it would not have been difficult to have driven these small headings forward through the soft ground, and to have constructed the sidewalks and thrown the masonry of the roof across from wall to wall by alternate sections. But the conditions of the sewers, built back forty years ago, and possibly also of the Croton water pipes, kept the ground saturated, and it was found to be of such a nature that it was being carried into the tunnel in suspension by the seepage.

Therefore, while it was quite practicable to build the tunnel by this method, it could not have been carried out without the probability of causing considerable settlement of the front walls of the old residence structures on either side of the street. Such structures as the larger hotels and business buildings would have caused no trouble, as the foundations of these buildings rest on the solid rock.

After careful review of the situation, it was determined to make application for permit to do the work by open cut under a temporary street surface, after the front walls of the buildings not resting on rock, had been carried down thereto, as shown in Fig. 1. This permission was ultimately granted by the Rapid Transit Commission, as it seemed to be to the best interests of the city and the property-holders.

At the time the application was before the Rapid Transit Commission, the railroad company having modified its trackage arrangements within and west of the station, found that it was reasonable to do away with the storage track east of Sixth avenue, and made plans by which the section from Fifth avenue to Sixth avenue could be changed to two-track tunnels, and the vertical curve shifted to Sixth avenue.

In the previous article standard sections of three-track and two-track tunnels were shown, and by reference to these it will be seen that the height of the three-track section was some 8 ft. greater than that of the two-track section. The change to the two-track section lowered the top of the roof 8 ft., and the change in grade gave 5 ft., thus lowering the grade of the roof below the bed of the old stream a total of 13 ft.

At this new grade of roof exploration drifts were sent forward, with the result that ample depth of solid rock was found over the tunnels, making it unnecessary to resort to open cut. It is, therefore, probable that the lower grade will be adopted, and that there will be no open cut, except for a short distance at the west end of 32d street, where it is impossible to change the grade, and where the structures are of such a nature that they can be readily protected and the work done, without great inconvenience, from the surface.

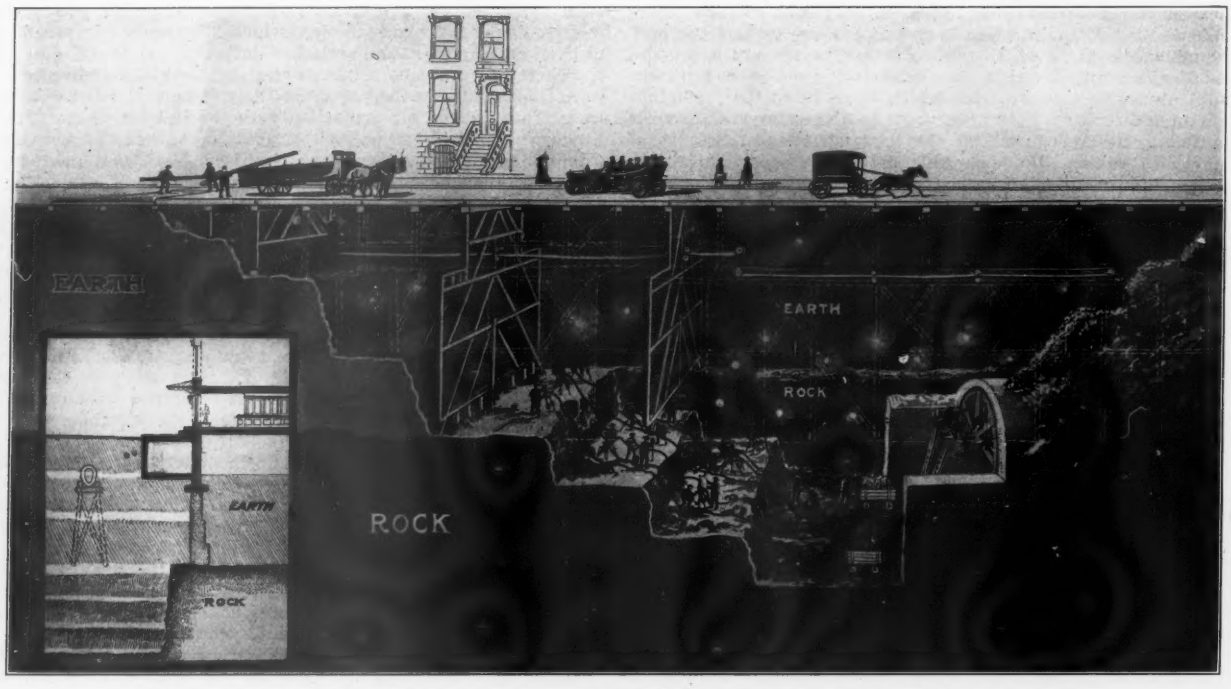


Fig. 1—Proposed Method of Excavating Pennsylvania Crosstown Tunnels West of Fifth Avenue.

The only other change in the plans for the excavation of the tunnel consists in sinking shafts at the west end for the purpose of hastening the completion of the work by driving eastward to meet the drifts on their way west from Fifth avenue. It is expected that the excavation will be entirely completed by November 1.

These tunnels have now been driven for 80 per cent. of their length, through solid rock, under the most thickly inhabited district of Manhattan, without damage to the buildings on either side of the street, and with an inconvenience so slight that the property-holders and tenants have expressed their high appreciation of the way in which the work has been handled, no serious complaints have been made.

At present the work of lining with concrete is well under way, and precisely as in the case of the excavation, the plant is driven entirely by electricity. The materials (cement, sand and broken stone) are received at the dock at the foot of East 35th street, furnished the contractor by the railroad company for his sole use.

The sand and gravel are unloaded by means of clam-shell

Fig. 2—Heading of Double Track Tunnel in Solid Rock.

Fig. 3—Completed Excavation for Two-Track Tunnel in Solid Rock.

buckets, two men, one operating the electric hoist and one the traps of the hopper under which the wagons drive to be loaded, being the only labor necessary to clear the boats. Both materials are unloaded at the rate of 50 cu. yds. an hour. The material is carted to the shafts, where it is dumped into bins constructed in the shafts, the top being at the ground level, and the bottom about 20 ft. above the grade of the tunnels.

The cement is also fed down to this level through a gravity device similar to the Louisville type of spiral fire-escape. Just beneath the hoppers of the bins are the charging platforms of the mixers. The batches are measured in boxes fed from the hoppers and dumped into the loading chutes of the "Smith" mixers, which in turn dump the material into the concrete cars, in which the mixed concrete is carried to the point of placement in the walls.

The operation of placing the concrete is as follows: The floors are first brought to the final level of the under side of the ballasted tracks, the idea being to obtain a smooth graded floor to give perfect drainage. On this floor of concrete are placed the rails of a 16-ft. gage track, on which the frames for the side walls and roof arch are run. When these rails are once lined and graded there is no further bother with engineering instruments in completing the tunnel masonry, since the forms are substantial and the tunnel section uniform throughout. The floor concrete is shown in place for half the tunnel, in Fig. 3.

The first operation for the side forms is to smooth up the walls for the waterproofing. These forms are shown in place in Fig. 4. When the waterproofing is finished the forms for the side walls complete are set up to a point somewhat above the spring of the arch. These forms are shown in place in Fig. 5.

It should be noted here that the cross-section of the twin tunnels shows a concrete central wall. However, as the two-track sections advance toward the East river, where the two tunnels of two tracks each are broken up into four sub-aqueous tubes passing under the river, the two tracks under each of the streets gradually separate, so that ultimately they are sufficiently far apart to leave a core of rock between. The point where the core of rock is left in place is shown in Fig. 5.

Fig. 4—Placing Forms for Concrete Side Walls.

Fig. 5—View in Tunnel near East River Shaft Showing Central Rock Wall.

Following the completion of the sidewalks, shown in Fig. 6, comes the placing of the arch forms. These may be freed from the concrete by being lowered, since the sidewalks are carried above the spring line of the arch. The steel forms for the arch are shown in place in Fig. 6.

Fig. 7 shows the completed arches of the tunnel, which is the standard section across town.

The forms are made in 32-ft. sections, and follow each other in close sequence as the work progresses. The arch concrete and the upper portion of the central wall is placed by an ingenious belt conveyor designed by the contractor and constructed for them by the Robins Conveying Belt Company. By the system adopted the labor of placing concrete is reduced to a minimum, although the investment in plant is large.

Much work has been accomplished in the 13 months of actual tunnel digging. Several records in tunnel work have been made. For several successive months after the plant got working a greater yardage was taken out of the six headings that were being driven simultaneously than has ever been taken out of six headings in any other tunnel. This is partly due, of course, to the unusual size of the drifts, but a record for linear feet of progress has been made on this job.

The great width of the headings was a peculiar advantage, owing to the necessity to pull the cuts in such a way that no damage would be done to the structures lining the streets when blasting. Three, and even four, relieving cuts have been used in order to maintain the desired daily progress and still keep within the limitations imposed by city ordinance and good judgment.

No material damage has been done by blasting. The absence of damage has been due primarily to an expenditure by the contractor that would startle a cross-country railroad tunnel builder; not only in the actual excavation below the surface, but in the headhouse plant and top charges made necessary in order to avoid noise and interference with the full enjoyment of their property by the neighboring house-holders.

So great a work could not, of course, be carried out without some annoyance. There has been arranged a regular hour for the receipt and consideration of complaints, and some of these have been more or less amusing.

For example, a young man in a large retail house, who had a contract to maintain the incandescent gas-burners, came in and promised dire punishment unless the blasting was altogether stopped, on the allegation that it was breaking his mantles.

It is curious to note how universal is the habit of not noticing cracks in the ceilings and walls until some attention is called to them. To avoid just this complication, examination was made of every house in the zone of influence of the work, and complete diagrams were made, with affidavits of the examining engineer at-

tached, showing all the cracks and faults existing before the work was undertaken. In practically every complaint that is filed a reference to the diagrams shows that the cracks complained of

Fig. 6—Steel Forms for Tunnel Arch.

existed, and in many cases the plaster was down before a blast was fired.

That no damage has been done to structures in good condition is clearly shown by the fact that the tunnels have been driven under the subway station at 33d street, built in the same rock and only 35 ft. above, without shaking loose one of the enameled veneer tiles.

George S. Rice, Chief Engineer of the Board of Rapid Transit Railroad Commissioners, had installed in this station a carefully constructed seismograph to determine the effect of the blasting. This was kept in position for five months, and while the tunnel was being driven from 400 ft. west of the station to 400 ft. east. The effect of the blasting was shown on the records as a momentary movement of the needle perpendicular to its travel when at rest. The record was merely a straight line about $^{3}/_{25}$-in. long, perpendicular to the line of rest. The seismograph happened to be in position at the time of the San Francisco earthquake, and the record made by that phenomenon extended over a period of 13 minutes. The record consisted of a wavy line, passing both sides of the line of rest, with a maximum versed sign of $^{5}/_{16}$-in. This shock was recorded simultaneously with the record made at the state house in Albany.

Another interesting situation developed with regard to a public school along the line. Here the woman principal, as well as her staff of teachers, were alarmed lest the children should become excited through the effect of blasting. The contractor asked that a committee of teachers be organized to make a visit to the tunnel for the purpose of seeing what was going on, and be reassured that no damage could result. This committee visited the tunnel, and were so impressed with the way the work was being conducted that all timidity disappeared, and no further complaint has been registered.

The excavation is now about 80 per cent. complete, and about 20 per cent. of the concrete has been placed. It is expected that the excavations will be entirely completed by the first of the coming year, and that the concrete will be practically finished by the end of the present season. What there is left to be done will take but a short time the early part of next season, and the work will be completed on contract time, early in 1908.

We are indebted to D. L. Hough, President, and Paul G. Brown, Managing Engineer, of The United Engineering & Contracting Company, for the information; to I. P. Gillette for the photographs, and to Capt. G. A. Coffin for the drawing, from which Fig. 1 was made.

Fig. 7—Completed Section of Standard Twin Tunnels.

Strength of Red and Yellow Douglas Fir Bridge Stringers.*

The terms red and yellow fir are not thoroughly defined. By some only close-grained, bright yellow sticks are designated yellow fir and all other sticks called red fir, while others call only close-grained sticks of a pronounced red color red fir and all other material yellow fir. Both red and yellow fir are secured from the same species—Douglas fir—and often from the same tree.

An analysis of the strength tests made by the Forest Service on Douglas fir stringers is shown in the attached table. These stringers were graded according to the export grading rules of the Pacific Coast Lumber Manufacturers' Association, and in the table are grouped by grades. In classifying the stringers according to color all timbers of a reddish tinge were called red fir and all of a yellowish tinge were called yellow fir. The rings per inch shown in the table indicate that yellow fir is of slower growth than red fir. It also ranges higher in grade. Of the 94 yellow fir stringers tested 47.8 per cent. were selects, 40.4 per cent. were merchantables and 11.8 per cent. seconds. Of the 162 red fir stringers tested 29.8 per cent. were selects, 43.8 per cent. were merchantables and 26.6 per cent. seconds, but, grade for grade, these tests show that there is practically no difference in the strength and stiffness of red and yellow fir in bridge stringer sizes:

Strength of Red and Yellow Douglas Fir Bridge Stringers.
(Yellow fir expressed in per cent. of red fir.)

Kind of fir.	Grade.	No. of tests.	Rings per in.	Per cent. of moisture.	Weight, per cu. ft. in lbs. As tested.	Weight, per cu. ft. in lbs. Oven dry.	Fiber stress at elastic limit, lbs., pr sq. in.	Modulus of rupture, lbs. per sq. in.	Mod. of elasticity, 1,000 lbs. pr sq. in.
Red...	Select..	48	10.3	29.6	38.2	29.5	4,427	6,974	1,645
Yellow	Select..	45*	17.5*	87.0	94.0	97.0	101	96	100
Red...	Merch..	71	9.0	29.7	35.9	27.7	4,056	6,019	1,534
Yellow	Merch..	38*	16.4*	90.0	97.0	99.0	101	102	97
Red...	Seconds	43	7.5	27.4	35.7	28.0	3,674	4,923	1,319
Yellow	Seconds	11*	14.5*	98.0	104.0	105.0	99	106	98

*Not expressed in per cent.

New York Central Freight-Yard Policemen.

A recent issue of the *New York Herald* contained an interesting account of the desperate contest which the New York Central & Hudson River has waged for the past few years with freight-car thieves in New York City, from which we quote as follows:

When A. H. Smith came from the West to become general manager he sent for Chief Inspector Humphreys and began to study the question. R. F. Humphreys, brother of the inspector, and like him, a veteran policeman, was called to the city and placed in charge. He went at it confidently and slowly. He used special care in picking his men. They had to be men who would be useful in emergencies, able to take care of themselves on and off moving trains. They had to be able and willing to stand off the attack of a half-dozen men in a lonely aisle of cars, with assistance far away. They had to be able to "hop" a freight, grab their man, throw him off and jump after him; they had to be alert and capable of long hours of duty. Above all they had to be honest. What use would the "force" be if a policeman could be bought to be at the other end of his post when there were valuable cars to be "ripped," or what further use would it be if a policeman could be induced to fail in his identification of the prisoner when on the day of trial?

It took something like three months to get the men, and when they were selected every one of them came from "up the state." All were young, all were lusty and all had proved their courage. Some had been policemen, others had been soldiers and several were active young college athletes who went into it because of the possible dangers of it. The twenty-seven of them were brought to the city a year ago last month and installed at the pier at the foot of West 49th street.

They were provided with everything any man would want. Their sleeping quarters were given to them, a gymnasium, shower baths, lounging and reading rooms and good salaries. A man that joins the force gets first $60 a month, but he works into a $125 salary if he shows the right spirit. If he does not deserve a raise he gets out; they don't want him. The long district is divided into three posts, or precincts—one at the milk station at 33d street, another at 59th street and the third at Spuyten Duyvil. Down around 33d street the milk thieves were working. This was a large band, usually working with company employees. Many a can of milk would be reported missing in the morning and no one could tell where it went.

Fifty-ninth street was the car thief district. That extended up above 99th street, and in this district there were a half-dozen well-organized bands, with some hundreds of independent operators. There were regular landing places along the Hudson river for the marine fleet, "fences" for disposing of property of all kinds, secret cuts, private ways and escapes. The district was divided by the bands impartially, and there was a "gentleman's agreement" among the thieves that made the rights sacred.

There was one band for the "new yards," as they were called, which begin at 60th street; there was the 69th street band, the band in 74th street, the "Bath House band," and so on up every few blocks. Spuyten Duyvil was the "yegg" clearing house. Through that point had to pass all the criminal tramps beating their way to the city.

This police force had been in existence just one year on May 17, 1907. During that period they made 1,351 arrests, and of this number there were a few more than 1,200 convictions. One-half of those arrested were charged with theft, larceny, robbery, burglary and highway robbery; a third more were for trespass and attempts at the same; others were for stealing rides and the like. The members of the force shot at least three men during the year, and two of their men were shot in return. One man was killed, Peter Michaels, a member of the 69th street band. There were at least three pitched battles, in which shots were exchanged, and the personal encounters were without number. Every man on the force was shot at, and often heard volleys of stones come whizzing by.

Of all the bands in existence a year ago, May 17, but one survives, the 69th street band, and out of that eight members are now serving terms of imprisonment. Michaels was shot and the leader dare not show his face across the tracks. The powerful political backing the band had a year ago is weakening, and visits to see "if something can be done to settle it" are not so frequent, nor is bail forthcoming so quickly as it was.

The men work twelve hours at a stretch and seventeen are on duty at night. F. D. Hunter is a graduate of Colgate University. Hunter, who is very quiet, tells about the work: "The Chief (and by the Chief he means Wilson A. Humphreys, at Albany) won't have a man who drinks, who has a spot on his record or who loses his head. He wants men, also, who are very good pistol shots. It is around 10 o'clock and the sergeant tells you it is time he made his rounds. He is compelled to do this just as in real police stations. If he finds a roundsman derelict there must be charges preferred and a policeman goes through the same ordeal. He starts out and is soon plunging ahead between a row of freight cars on one side and a moving train on the other. It is not pleasant walking for the visitor. Every one of our men along the track has his post, but he does not patrol it as a regular policeman would. You will usually find him hidden between cars or lying flat on a roof in a bad locality. He does not need to walk around, for the reason that there never has yet been made a car door that did not rattle or squeak when it was opened. He waits for that rattle, and when he hears it he runs.

"We've caught them trying to get away with sewing machines and machinery parts. They'd ruin $1,000 worth of machinery for $10 worth of brass."

To the left or river side of the track now spring up low sheds, bathhouses and heavy houseboats. "This is where Michaels was killed," says Hunter. "We got into the place this spring and got a carload of stuff. The keeper is now doing time. You've got to keep watch on all these places. Over there," pointing to a small dump pier, "is where the boats come in. They come from over in Jersey, and they are a bad crowd. We got eight of them and one of their boats this spring. They are pretty well scared now."

"This is where the park begins. That was their best hold. They could rush a trainload of stuff over in there and get away with it. We have had some good fights up along here. They usually work in bands of four or more, so they are ready for a fight. Usually a boy acts as their scout, and he comes on the track, as if he were going over to the river. If the coast is clear he whistles or coughs, and the men are over the wall into the car in half a minute. * * *"

Foreign Railroad Notes.

The Prussian State Railroads call for bids for 700 locomotives, to be delivered between April 1 and Oct. 31, 1908. The call is addressed only to those works which have heretofore received orders from these railroads.

At the beginning of the summer traveling season this year the Prussian Minister of Public Works issued a circular to his railroad subordinates in which he enjoined the strictest attention to maintaining passenger cars in good condition; to see that at terminal points they are kept cool and provided with cold water. Conductors and guards must see that the doors close tight and do not stick, that the door fastenings are in order, that the window blinds do not rattle, that windows open and close easily, that the window curtains are in order, that the lamps burn properly, that the lavatories are clean and provided with plenty of water. Well founded complaints of passengers should be attended to, when possible, during the trip, without waiting till the terminal station is reached.

*Bulletin of the U. S. Department of Agriculture, Forest Service.

GENERAL NEWS SECTION

NOTES.

In the Federal Court at Rochester, N. Y., July 5, the New York Central & Hudson River was fined $15,000 for carrying oil, shipped by the Standard Oil Company, at a secret rate.

The Mexican Central is to put cupolas in the roofs of the baggage cars of all through trains, in order to make it easier for the conductor to keep watch of the movement of his train.

Suits have been filed in the Federal Court at Des Moines, Iowa, to enjoin the Minneapolis & St. Louis and the Iowa Central from adopting the 2-cent fares prescribed by the Iowa law.

The Atchison, Topeka & Santa Fe has notified the Attorney-General of Missouri of its compliance with his request to cease issuing passes in that state; and it is said that the Burlington, the St. Paul and some other roads will comply.

The Delaware & Hudson Company is receiving 450,000 ties from the South. The company bought but few ties last year because of the high prices. The ties arrive in New York by the Mallory line and are transferred to canal boat and barges of the Myers line for Albany.

Cattlemen of western and northwestern Texas say that since last March the railroads have been unable to supply more than half the cattle cars that shippers need, and that consequently thousands of animals are dying for want of water. Claims are being presented for damages due to delay in furnishing cars.

Since the fire of April, 1906, the ferries of the Southern Pacific between San Francisco and Oakland have carried 2,000,000 passengers a month, as against an average of 1,300,000 before the fire. These boats have carried in 40 years about 300,000,000 passengers. Of this number only three lost their lives while using the ferry.

Following a loss of travel in consequence of increased competition from street railroads, the Philadelphia & Reading has taken off a number of passenger trains between Philadelphia and Chestnut Hill; also some from the Glenside division. At Tioga (about three miles from the terminal), where trains of several divisions pass, the number of trains stopping each day is now 40 less than under the last time-table.

The United States Civil Service Commission, Washington, is to receive applications August 1 for positions in the Department of Accounts in the Interstate Commerce Commission. The positions to be filled are those to be established in connection with the inspection of railroad companies' accounts under the revised Interstate Commerce law. Applicants must have railroad experience and must know at least as much as a traveling auditor.

At Catalla, Alaska, July 4, a fight with clubs and pistols between rival railroad construction forces was accompanied by a novel feature, a "go-devil." The go-devil is something like a battering ram. It is erected at the point of intersection of the two lines and is kept in motion in such a way as to prevent the enemy from doing any work within its range. This machine was put up by the Brunner forces but it was captured by the Guggenheim forces.

The Mayor of Philadelphia has signed the ordinance under which the Philadelphia Rapid Transit Company receives limited street railroad franchises throughout the city for 50 years with a provision that the city is to have half of the income from operation in excess of 6 per cent. on the capital paid in. The city is to be represented in the board of directors by three persons—the Mayor and two selected by the councils. This arrangement was proposed by the Retail Merchants' Association, but it was opposed by the Reform Party.

Governor Comer, of Alabama, in his message to the Legislature last Tuesday complained that the state railroad laws are "held up" by injunction in the Federal Court the same as in Iowa. He said: "Discrimination has been proved, and it is a great hardship for Alabama to be forced to go through court processes on a case already pioneered and worked out and demonstrated." The Governor advocated biennial sessions of the Legislature and the passage of an anti-lobby bill.

The record for May shows the greatest aggregate movement of freight cars in the history of the Pennsylvania road. The total freight car mileage for the month was 122,770,303. The number of freight cars moved on the Pennsylvania's eastern lines during May averaged 146,476 a day; average daily movement of each car 27.07 miles. These figures do not include cabooses. On May 24 the interchange between the eastern and western lines at Pittsburg totaled 8,704 cars, which was 650 more cars than had ever passed between the lines before in one day.

The New York Central has issued on the Pennsylvania division an order doing away with a third brakeman on all rounds crews except way freights, pick-up and through trains. Henceforth one brakeman, one flagman and a conductor with the engineer and fireman will constitute a full crew. Owing to the great amount of construction work going on and the extra work trains on the road the third man has been thus far retained, though with every car in a train equipped with automatic couplings and air brakes, only two brakemen are ordinarily deemed necessary.

In the United States Circuit Court at Chicago the Federal District Attorney has asked for injunctions to restrain five prominent express companies from granting franks to their employees and others. One of the defendants, the United States Express Co., in its answer contends that it is not a common carrier. The revised Interstate Commerce law, under which the provisions of the act now apply to express companies, has a long section containing a list of exceptions to that clause of the law which forbids free transportation, but the exception as regards employees applies only to the transportation of persons, not property.

The Cincinnati Chamber of Commerce has issued a circular to its members, requesting them to load cars to their marked capacity. It is pointed out that in view of the increased capacity of cars, averaging now nearly 60,000 lbs., the loading of cars to the minimum limit of 24,000 lbs., 30,000 or 40,000 lbs. is a waste of space which is an injustice to the commercial public, both railroads and shippers. This should be laid before certain legislatures and railroad commissions, which, though supposed to be fountain heads of justice, issue laws and rules perpetuating the injustice here mentioned.

Electrification in Australia.

It is proposed to electrify the suburban lines about Melbourne, Australia, for which purpose the government is prepared to spend $15,000,000. The system to be adopted is now under discussion.

St. Louis Railroad Terminals.

The Municipal Bridge and Terminals Commission of the city of St. Louis, which is a board of nine public spirited citizens, appointed by the municipal assembly, with Mr. Rolla Wells as chairman, says in its fourth report, recently submitted, that plans are being made for the improvement of the extensive tracts of land recently acquired by the Terminal Railroad Association for the enlargement of its freight yards, and will soon be laid before the Municipal Assembly. The commission reports that the executive officers of the railroads centering in the city have worked with the commission in a friendly spirit. Indeed, the marked success of this commission during its two years' life appears to have been due largely to the reasonable attitude of mind evinced by its members. Unlike some bodies of municipal representatives, these gentlemen evidently do not invariably approach the railroads with a demand for every possible improvement that can be thought of. In securing the abolition of the differential rates between St. Louis and East St. Louis on all freight from the east, except from points within 100 miles, the commissioners have secured reductions aggregating many hundred thousand dollars yearly for the business men of the city, but in modestly stating this in the report they admit some of the points made by the railroads and frankly declare that from points within the 100-mile radius the existing rates are entirely fair to all interests. In the matter of passenger fares, also, the commission for the present keeps its hands off, believing that there is nothing in the situation which will not probably adjust itself in the near future to the satisfaction of the city.

The commission still has much work before it and asks for an appropriation to continue its investigations. The elaborate plans for a new bridge across the river and the arrangements for a large number of new freight houses are yet to be worked out. The commission believes that the different railroads doing business in the city should each deal with the public through its own agents. The public is jealous of any appearance of monopoly and the prejudice against the Terminal Railroad Association cannot be extirpated. To give, on the joint terminals, really satisfactory service the agent of each road must be able to act as though he were working on a part of his own road; and, while there can be no objection to an

agent serving two or more roads, he should do business in the name of the individual railroad company.

Washington Railroad Commission's Rules.

The Railroad Commission of the state of Washington has issued a code of eleven rules governing passenger and freight traffic which the railroads of the state are directed to print on large cards and post in their passenger stations. Rule 1 makes all regular tickets good for 30 days. Rule 2 requires railroads to redeem unused tickets within six months at any general passenger office or at the station where sold. Rule 3 requires the three principal roads of the state to sell at all coupon stations 2,000-mile tickets at $50. Unused parts of mileage books must be redeemed after one year at 2½ cents a mile. Before the end of the year, unused parts may be redeemed allowing 3 cents a mile for the part used. A firm having bought a ticket for an employee may return it and have the unused portion credited on the purchase of a new book for another employee.

Rule 5 requires clean and comfortable waiting rooms and toilets. Rule 6 requires bulletin boards for delayed passenger trains, and rule 7 requires notice to be given at stations and on cars when a train is likely to meet an obstruction delaying it more than 30 minutes.

Rule 8 requires every station agent to keep a record, open to inspection, of applications for cars and how they are filled, etc. Rule 9 requires a similar record in the superintendent's office, and a monthly abstract of this must be sent to the railroad commission. Rule 10 requires every passenger train to be fitted with a hose and valve at the rear end so that in moving the train backward the rear brakeman can control its speed.

The New Commissions in New York State.

The Public Service Commission of New York State, Second District (headquarters at Albany), has announced the retention of the following employees of the old Railroad Commission, at the same salaries for the present: Steam railroad inspector, J. D. Schultz; inspector of electric railroads, C. R. Barnes; expert on accidents, E. F. Vanhoesen; locomotive inspector, G. P. Robinson; superintendent of grade crossings, A. H. Sutermeister; inspector of grade crossings, J. E. Brazee.

The Commission has been too busy organizing to attend to specific complaints. All matters relating to railroads have been referred to a committee of which Commissioner Sague is chairman, and Commissioner Decker is to attend to all matters relating to tariffs. All roads must file tariffs by November, 1907.

The commission has set hearings for each of the first three days of next week on applications for new security issues and proposed extensions and improvements to various railroads.

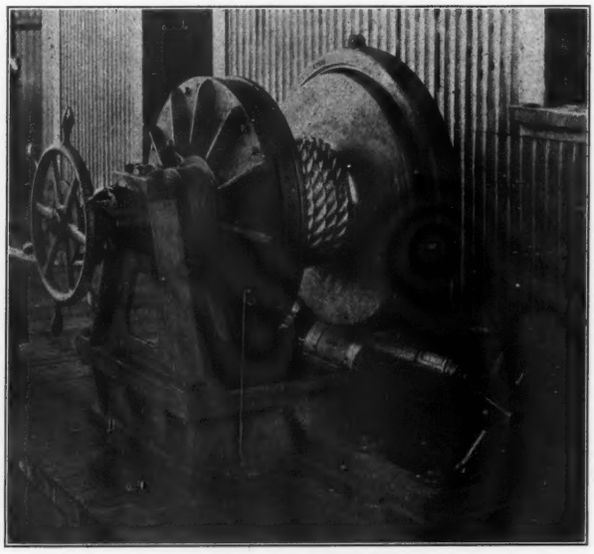
The commission has created a division of light, heat and power and appointed Henry C. Hazzard, former secretary of the gas commission, as the chief clerk at a salary of $4,000 a year. Mr. Hazard's salary as secretary of the gas commission was $3,000 a year.

On the suggestion of the commission of the first district a conference between the two public service commissions will be held to formulate uniform rules of procedure.

The commission for the first district (New York City) has ordered all railroad companies within that district—steam and electric, subway, surface and elevated—to send to the Commission memoranda of their accounts, showing their systems of bookkeeping; also to furnish a complete record showing the movement of traffic, a schedule of all cars and trains in commission on the first day of July, giving the exact scheduled starting time of each car or train on every trip; the exact time of its scheduled arrival at destination, with the incidental statistics concerning distances, number of runs for each car and the headway. The same order calls for each company's estimate of the number of cars it expects to have in use on September 1 of this year, with the total seating capacity, and, for purposes of comparison, the number of cars, with total seating capacity, in commission on September 1, 1906, and September 1, 1905.

Lidgerwood Slip-Drum Electric Winch for Car Ferries.

At the three car ferry transfer bridges of the Pennsylvania at the Greenville, N. J., terminal yards there have been in use for nearly three years a number of motor-driven slip-drum hauling-in winches of novel construction made by the Lidgerwood Manufacturing Co., New York. These bridges are operated entirely by electricity and the winches are controlled from a cab or tower by the same operator who manipulates the raising and lowering mechanism. The winches were designed to overcome the difficulty and danger of hauling in by hand power and to prevent the parting of the mooring lines in rough weather or under the shock of running cars on the floats.



Lidgerwood Slip-Drum Electric Winch.

Transfer Bridge at Greenville Yard, Showing Lidgerwood Slip-Drum Hauling-In Winch.

Each winch is moved by a 10 h.p. General Electric d.c. motor geared to develop 5 h.p. at 900 r.p.m. The motor turns the drum through a steel worm running in oil. Each end of the worm shaft is provided with a roller thrust bearing. The drum is 14 in. in diameter and has a 14-in. face. It carries a manila hawser 2 in. in diameter which it hauls in at a speed of 10 ft. a minute. The winch complete with motor occupies a space 56½ in. long, 44 in. wide and 52½ in. high.

The slipping drum friction is of the type developed by Spencer

Miller for maintaining a constant tension on the cables used in the Lidgerwood cableway for coaling ships at sea. It is designed to slip continuously under full pressure for an hour at a time without destructive wear or heating and to maintain a constant tension on the hawser of any desired amount. The frictian can be adjusted by the operator to give any strain. The winches at Greenville are adjusted to exert a pull of 11,000 lbs. before slipping and a continuous pull of 9,000 lbs. while slipping. The drum is normally loose on its shaft and is lined with bronze bushings to take up wear while slipping. At its ends the drum is provided with steel friction rings rubbing against soft steel and soft cast-iron friction blocks mounted in the surrounding casing. The surfaces of the rings and blocks are brought together with the required degree of pressure by means of a threaded screw and a combination of springs. The friction produced is of peculiar quality. The coefficient is high and varies only slightly between a state of rest and movement.

In operating the winches the mooring lines are made fast and the motors started. While bringing the float in, if it rebounds or is bumped by a tug or high wave the drums slip before a breaking strain comes on the hawsers, but continue to exert a pull sufficient to check the movement of the float. If for any reason the float should break away while loading or unloading cars the winches check the movement and are ready immediately to haul in again before any damage is done. During the three years they have been in use at Greenville they have been subjected to many severe tests and have been satisfactory in every way.

Two-Cent Passenger Fares in Many States.

Reports from Chicago to the effect that passenger fares are to be reduced to 2 cents a mile on many roads even where not required by law continue, and the air of authenticity is maintained; but no official announcements are yet given out. An Assistant General Passenger Agent of the Burlington at Omaha is reported as saying that his road will within 10 days announce rates of 2 cents a mile between all points on the entire Burlington system, extending into 11 states. Notices sent to the Interstate Commerce Commission—which of course deal only with interstate rates—are said to indicate that all of the prominent roads expect within the present month to adopt the 2-cent rate throughout Illinois, Wisconsin, Minnesota, Iowa and Missouri.

At Richmond, Va., July 10, Judge Pritchard, in the United States Circuit Court of Appeals, continued the restraining order against the enforcement of the uniform 2-cent passenger rate ordered by the State Corporation Commission.

INTERSTATE COMMERCE COMMISSION RULINGS.

Equal Facilities for Negroes.

The Interstate Commerce Commission on July 8 decided the case of Georgia Edwards v. the Nashville, Chattanooga & St. Louis, which involves the right of interstate carriers to discriminate between negroes and whites in facilities furnished.

Immediately after the Rate Law took effect the complainant, a colored woman, purchased a first class ticket from Chattanooga, Tenn., to Dalton, Ga. She entered the car assigned to the use of white passengers but was removed to the car assigned to colored people. She filed a complaint, alleging discrimination in the facilities furnished to her as against those provided for white passengers. The opinion is rendered by Commissioner Lane, who holds that where a railroad provides certain accommodations for first class white passengers it is commanded by the law that like accommodations shall be provided for colored passengers of the same class. The following statement of facts precedes the conclusion of the opinion:

The train in question was defendant's No. 93, which leaves Chattanooga at 6:36 a. m., and arrives at Dalton at 7:38 a. m. The distance from Chattanooga to Dalton is 38 miles. This train started from Nashville, 151 miles northwesterly of Chattanooga, and before it left Nashville, all the cars were thoroughly cleaned inside. They were again cleaned to some extent at Chattanooga. Both at Nashville and at Chattanooga the cleaning process applied equally to both the passenger coaches in the train. These two cars are of the same quality, having seats of the same size, upholstered in a like manner and with exactly the same quality of goods. One of them is used by white passengers and is provided with towels and washbowls, while the other is without such conveniences. The latter is constructed as follows: A partition placed in the middle of the car divides it into two compartments, and entrance from one to the other is had through a swinging door which, after being opened, closes automatically. Negro passengers are required to occupy one of these compartments, while the other is occupied by other passengers who wish to smoke.

In one end of the other passenger coach there is a compartment for smokers which will seat seven persons, but defendant does not provide any separate smoking compartment for negroes. It is also true that while only one toilet is provided in the negro compartment, the car which is entirely used by other passengers has two, marked in such a way as to indicate that one is to be used by men and the other by women; but such restriction is only partially enforced. The principal reason for providing two toilets in one case and only one in the other is that the number of passengers carried in the negro compartment is very much less than the number contemporaneously transported in the other car. Defendant assigns to the use of negro passengers about one-sixth of the space in its passenger trains occupied by all passengers, while the number of negroes transported by defendant is only about one-fifteenth of the total. When there are no women in the colored compartment, smoking there is allowed, but not otherwise. It sometimes happens that a car provided by defendant for the use of white passengers has no washbasin and only one toilet and no smoking compartment, and that smoking is allowed in such cars if there are no women present.

On the whole, defendant's Nashville-Atlanta passenger trains are among the best in the country, so far as equipment is concerned. The cars are manufactured by the Pullman Co., and vestibuled. The cost of the car allotted to negroes was about $8,100, while that of the other passenger car in train No. 93 was about $8,800. The expense of the small smoking compartment in the latter accounts for nearly all the difference in cost.

Commissioner Lane holds that the broad question of the right under the thirteenth and fourteenth amendments of the Constitution to segregate white and colored passengers has been upheld by the Supreme Court of the United States and the Interstate Commerce Commission in previous decisions. The opinion concludes:

While, therefore, the reasonableness of such regulations as to interstate passenger traffic is established, it by no means follows that carriers may discriminate between white and colored passengers in the accommodations which they furnish to each. If a railroad provides certain facilities and accommodations for first-class passengers of the white race, it is commanded by the law that like accommodations shall be provided for colored passengers of the same class. The principal that must govern is that carriers must serve equally well all passengers, whether white or colored, paying the same fare. Failure to do this is discrimination and subjects the passenger to "undue and unreasonable prejudice and disadvantage." In this case it is manifest that defendant has unduly and unjustly discriminated in some particulars against colored passengers, and it will be ordered therefore that where the defendant carrier provides a washbowl and towels in coaches devoted to the use of white passengers and also a separating smoking compartment for such passengers, that similar accommodations shall be provided for colored passengers paying first-class fare.

Application for Rehearing Denied.

The Interstate Commerce Commission has announced its decision, rendered by Commissioner Clark, on the motion of the Missouri Pacific and the Chicago, Burlington & Quincy for rehearing in the case of the City Council of Atchison, Kansas, against those companies and others. In the original decision the Commission held that defendants should abstain from withholding the same or equivalent elevator allowances or free services in connection with elevation and transfer of grain at Atchison which are at the same time granted or furnished at Kansas City, Mo., and Kansas City, Leavenworth and Argentine, Kan.

The motion for rehearing contained various reasons for its being granted, which are discussed, but held not sufficient for granting a rehearing. In denying the motion the Commission says: "While the power to grant a rehearing is discretionary, it is not believed that the petition presents a situation which makes it necessary or advantageous so to do. The petitioners had an opportunity to fully present their case, but the counsel of the Missouri Pacific did not submit any testimony and did not show enough interest in the proceeding to remain throughout the hearing. Full hearing was had and briefs were filed. No allegation has been made that the case was not completely submitted. It is not alleged that the decision of the Commission is erroneous or that since the hearing evidence has been discovered which was not at that time known. It is not asked that some matter not previously presented or considered should be now brought to the attention of the Commission."

Relation Between Wheat and Flour Rates.

The Interstate Commerce Commission, in an opinion by Commissioner Prouty, has announced decision in the case of Howard Mills Co. vs. the Missouri Pacific and other carriers. The complainant alleged that the defendant carriers unduly discriminated against Kansas millers in favor of California millers by exacting rates for transportation of flour which were 10 cents greater per 100 lbs. than the rates for transportation of wheat from Wichita and other shipping points in Kansas to points in California known as "Pacific coast terminals," and also by exacting rates for transportation of flour which were 35 cents per 100 lbs. greater than the rates for transportation of wheat from these shipping points to Phoenix, Ariz. The Commission decides that the flour rates between the said shipping and destination points should not exceed the wheat rates by more than 7 cents per 100 lbs.

The Commission says that there is no inflexible requirement that rates on grain and the products of grain should be under all circumstances the same, but rather that carriers may, in just regard for their own interests or to meet special conditions, vary those rates within narrow limits. When, however, the relation has

been established, business developed and money expended on the strength of it, then the carrier cannot, in the absence of some sufficient reason, change that relation, nor would the Commission direct such a change.

Commodity Rates to Amarillo, Tex., Reduced.

In an opinion by Commissioner Prouty, the Commission has decided the case of Nobles Brothers Grocery Company and others against the Fort Worth & Denver City and others. It appears in this case that a certain defined territory in the northern part of Texas, commonly known as the Burnt district, takes from Kansas City and other Missouri river points lower rates than are made to the balance of the state, in recognition of greater proximity to these Texas points; the class rates from Kansas City to Fort Worth, representative of the Burnt district, are higher than from Kansas City to Amarillo (where complainant does business) though Amarillo is less than the average distance to the Burnt district; and that the Santa Fe is rebuilding its road to Amarillo, which will soon be situated on its main line. The Commission decides that the present class rates from Kansas City to Amarillo are unreasonable and unjust, and that the commodity rates between said points should not exceed those from Kansas City to Fort Worth; but that the class rates from St. Louis to Amarillo may properly be higher than from St. Louis to Fort Worth.

MANUFACTURING AND BUSINESS.

The Pittsburg Steel Company, Pittsburg, Pa., is to issue $4,000,000 first mortgage 6 per cent. bonds to pay for building at Monessen eight 60-ton open hearth furnaces, a blooming mill and three billet mills.

J. W. Williams has been appointed sales agent in southern states for the Carbon Steel Co., Pittsburg, Pa., with office at 426 Lincoln Trust building, St. Louis. Mr. Williams continues to represent Brown & Co., Inc., Pittsburg.

Solomon Ginsburg has been elected President of the New York Car Wheel Company, Buffalo, N. Y., succeeding Joseph H. Berry, deceased. W. G. Smith has been elected Vice-President and J. A. Venable, Secretary and Treasurer.

The Westinghouse Electric & Manufacturing Co., Pittsburg, Pa., has sold to Kuhn, Loeb & Co., New York, $6,000,000 three-year, 6 per cent. notes, dated August 1, 1907. They were issued to retire an issue of the same amount of 5 per cent. notes maturing August 1.

A special meeting of the stockholders of the Safety Car Heating & Lighting Company, New York, has been called for July 15 to act on a proposal to increase the capital stock from $5,000,000 to $10,000,000. The new stock is to be issued to present holders as a 100 per cent. stock dividend. The annual dividend rate has been 18 per cent. for the last two years.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

National Association of Railroad Commissioners.

The annual meeting of this organization is to be held at Washington, D. C., October 8, and not in the state of Washington, as had been announced.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Delaware, Lackawanna & Western.—The general offices in New York City have been moved to 90 West street.

Grand Trunk.—William Wainwright, General Assistant and Comptroller, has been elected Fourth Vice-President, with office at Montreal, succeeding F. H. McGuigan, who went to the Great Northern last March. Mr. Wainwright's former office has been abolished.

Randolph & Cumberland.—Ira A. McCormack, Assistant to the General Manager of the New York Central & Hudson River, has been elected President and General Manager of the Randolph & Cumberland, with office at New York.

Operating Officers.

Chicago, Rock Island & Pacific.—See Houston & Texas Central.

Delaware & Hudson.—C. E. McKim has been appointed Superintendent of Car Service, with office at Albany, N. Y.

Houston & Texas Central.—J. F. Sugrue, formerly Superintendent of the Chicago, Rock Island & Pacific at Dalhart, Tex., has been appointed Assistant Superintendent of the Houston & Texas Central at Ennis, Tex., succeeding D. Black, resigned.

Illinois Central.—Patrick Laden, Assistant to the Assistant Chief Engineer, has been appointed Superintendent at Mattoon, Ill., succeeding Otto Schilling, resigned.

Mexican Central.—A. F. Chreitzberg has been appointed Trainmaster at Gomez Palacio, Durango.

New York Central & Hudson River.—See Randolph & Cumberland under Executive, Financial and Legal Officers.

Norfolk & Western.—G. W. Merrell, Assistant to the General Superintendent, has been appointed Assistant to the General Manager, with special duties in connection with maintenance of way and accounts.

Southern Pacific.—A. B. Stickney has been appointed Superintendent of the San Joaquin division, with office at Bakersfield, Cal., succeeding W. H. Averell, promoted.

Texas & New Orleans.—D. T. Wacther, yardmaster at Beaumont, Tex., has been appointed Trainmaster, with office at Jacksonville, Tex., succeeding A. K. Frye, resigned.

Traffic Officers.

Buffalo, Rochester & Pittsburg.—R. W. Davis, General Freight Agent, has been appointed Freight Traffic Manager, with office at Rochester, N. Y. F. W. Bale succeeds Mr. Davis, with office at Rochester.

Colorado Southern, New Orleans & Pacific.—George A. Hill, Industrial Agent, has been assigned to other duties and his previous position has been abolished.

Philadelphia & Reading.—R. L. Russell, freight claim agent, has been appointed Assistant General Freight Agent in charge of through and export freight traffic, with office at Philadelphia, Pa., succeeding E. B. Crosley, who has been appointed Coal Freight Agent.

St. Joseph & Grand Island.—C. T. Hummer, city passenger agent and chief clerk to the General Freight and Passenger Agent, has been appointed to the new office of Assistant General Passenger Agent.

St. Louis & San Francisco.—W. R. Powe, Assistant General Freight Agent at Memphis, Tenn., has been appointed Chairman of the Southern Freight Classification Committee, with office at Atlanta, Ga., succeeding P. J. McGovern, deceased. E. T. Willcox, division freight agent at Birmingham, Ala., succeeds Mr. Powe.

Union Pacific.—W. S. Basinger has been appointed Assistant General Passenger Agent at Omaha, succeeding Gerritt Fort, resigned.

Wabash, Chester & Western.—W. S. Easton has been appointed General Freight and Passenger Agent, with office at Chester, Ill., succeeding C. E. Kingsbury, who remains Auditor.

Wheeling & Lake Erie.—H. S. Bradley, commercial agent at Pittsburg, has been appointed General Agent at Canton, Ohio, succeeding C. C. Wilson, transferred.

Engineering and Rolling Stock Officers.

Chicago, Burlington & Quincy.—William Baird has been appointed General Car Inspector of the lines west of the Missouri river, with office at Lincoln, Neb., succeeding E. S. Barstow.

Grand Trunk.—Joseph Hobson, Chief Engineer, has been appointed Consulting Engineer. Howard G. Kelley, Chief Engineer of the Iowa Central and of the Minneapolis & St. Louis, succeeds Mr. Hobson. William McNab, Assistant Engineer at Montreal, has been appointed Principal Assistant Engineer. The offices of all are at Montreal.

Illinois Central.—L. A. Downs, roadmaster at Chicago, has been appointed Assistant Chief Engineer of Maintenance of Way. See this company under Operating Officers.

Peoria & Eastern.—W. P. Feeley, Assistant Engineer, has resigned to go into other business.

LOCOMOTIVE BUILDING.

The Canadian Pacific, it is said, has decided to build 50 heavy freight locomotives.

The Pennsylvania Lines West, it is said, have decided to order five passenger locomotives and 45 freight locomotives.

The Iroquois Iron Company, Chicago, has ordered one saddle tank locomotive from the Baldwin Locomotive Works.

The Portland & Seattle denies being in the market for five switching locomotives, as reported in the *Railroad Gazette* of July 5.

CAR BUILDING.

The Illinois Traction Company, it is said, has recently ordered 10 cars from the American Car & Foundry Company.

The Missouri, Oklahoma & Gulf, as reported in the *Railroad Gazette* of July 5, has ordered 200 coal cars of 80,000 lbs. capacity from Barney & Smith.

The Rochester, Syracuse & Eastern has ordered, through J. G. White & Co., from the Niles Car & Manufacturing Company, 15 combination passenger and baggage cars and two express cars; each car has four 75 h.p. motors.

The Buffalo & Susquehanna has ordered, it is said, 500 steel gondolas of 100,000 lbs. capacity from the Pressed Steel Car Company, and is in the market for 1,000 additional steel gondolas, 200 box cars and 100 coke cars.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALASKA ROADS.—About 20 miles of railroad has been built by the Guggenheimer interests (American Smelting & Refining Company) from Catalla, Alaska, towards the Copper river district. Between 800 and 1,000 men, it is said, are at present building the line. At Catalla the company is building a breakwater, and it is also doing a large amount of bridge work near that place. A branch is to be built from a point about 18 miles from Catalla into the coal fields. M. K. Rodgers, of Seattle, Wash., is in charge of the work.

ATCHISON, TOPEKA & SANTA FE.—There are to be extensive improvements to the line through Wellington, Kan. Contracts for the work are to be let in a few days. About 150 miles of the line beginning at Cicero, a few miles north of Wellington, is to be rebuilt. It is thought that the contract for the work will be let to Bancroft & Doty, of Topeka, who offered to do it for $440,000.

BUCKHANNON & NORTHERN.—This company, which started grading about four years ago on a line from Bellington, W. Va., north to New Brownsville, in Monongahela county, about 60 miles, and suspended work some time ago, has recently started surveys and will resume work on the line. About 45 miles is graded. S. T. Brady, Parkersburg, W. Va., Chief Engineer. (March 15, p. 380.)

CAIRO TERMINAL TRACTION.—The Illinois Traction System, otherwise known as the McKinley Syndicate, has organized a company under this name with a capital of $500,000, and office at Cairo, Ill., to build an electric line from Cairo north about 20 miles to the northern boundary of Pulaski county. It is said the company intends to eventually extend the line north to a connection with the McKinley lines at St. Louis and East St. Louis, and to build other extensions to connect with electric lines in the southern part of Illinois. The incorporators include: L. E. Fisher, D. H. Sawyer, W. S. Dewey, H. F. Vogel and D. Hogan.

CANANEA, YAQUI RIVER & PACIFIC.—See Southern Pacific.

CANYON CITY & NORTHWESTERN.—Incorporated in Texas with a capital of $100,000 to build a line from Canyon City, Tex., northeast to Yarnell, in Carson County, about 36 miles. The general offices are at Canyon City. The incorporators include C. T. Ward, L. G. Conner, J. M. Black, W. F. Weller, R. W. O'Keefe, D. M. Stewart, all of Canyon City.

CAPE FEAR, SOUTHPORT & ATLANTIC.—Incorporated in North Carolina, with $1,000,000 capital and office at Southport, to build a line from Southport, N. C., west to the North Carolina state line, 40 miles; also from Southport north to Wilmington, 25 miles. The incorporators are A. J. Fahnestock, F. S. Pusey and C. F. Anck, of Philadelphia, Pa.

CARTHAGE RAILROAD.—See Randolph & Cumberland.

CHICAGO & ALTON.—The cut-off from Iles, Ill., to Murrayville, on the Kansas City division, 35 miles, is to be opened for traffic about August 1. See article on page 33.

CHICAGO, ROCK ISLAND & PACIFIC.—A contract is reported let by this company to John J. Fox, of Fort Worth, Tex., for ballasting work on lines in Texas.

CHICAGO SOUTHERN.—This road is to run from Chicago Heights, Ill., where it connects with the Chicago Terminal Transfer, south 114 miles to the Indiana state line, where it connects with the Southern Indiana, which runs to Terre Haute. Track has been laid for 11 miles from the state line north and for 65 miles from Chicago Heights south. It is said that work has been started toward completing the gap. Arrangements for the reorganization of the company's finances are well under way.

CHICAGO SUBWAY, ARCADE & TRACTION COMPANY.—This company, which was organized in 1894, and of which William Penn Nixon is President, announces that it is going to take over the Arnold subway project for which plans were made by Bion J. Arnold. The company has applied to the city government for franchises to build a double-deck subway system, to consist of three north and south lines from the northern boundary of the city of Chicago to its southern boundary, and three west side lines from the central district to the western city limits. S. D. Goodins, S. M. Rowe and John M. Ewen are interested.

DEFIANCE, HICKSVILLE & FORT WAYNE (ELECTRIC).—Incorporated in Ohio with $10,000 to build electric lines. The incorporators include W. E. Golding, H. C. Eplert, M. O. Topliff, E. E. Murphy and M. I. Brown.

FAIRMONT & MANNINGTON (ELECTRIC).—Contract is reported let to the Blodget Construction Company, of Wheeling, W. Va., by this company, which is being promoted by New York capitalists, to build an electric line from Fairmont, W. Va., west to Mannington, 15 miles.

LONG ISLAND.—Final consent having been obtained from the New York City Board of Estimate and Apportionment, work on the change of line of the Manhattan Beach line will begin at once. This work, being done under the direction of the Brooklyn Grade Crossing Commission, is part of the Bay Ridge Improvement. It will remove, altogether, about 80 grade crossings on the Long Island Railroad between Bay Ridge and East New York, and between Manhattan Beach Junction and Manhattan Beach. The contract has been let to Walter H. Gahagan. Construction forces are ready and filling will begin at once. The Brighton Beach improvement, under direction of the Grade Crossing Commission, has been finished, so far as highway crossings are concerned. Two tracks are already in operation and the other two will probably be ready by autumn. It is estimated that it will take about a year for the Long Island Railroad's tracks to be laid on the new elevated grade. **Work on the Bay Ridge line** from the shore of the bay to East New York is being pushed to completion. At several points trains are already running on the new grade. (See Brooklyn Rapid Transit, March 15, p. 380.)

MEXICAN ROADS.—R. S. Towne, of New York, and associates are projecting a line from the city of Zacatecas, Mex., northwest to Durango, 250 miles. Mr. Towne is interested in the Mexican Northern and in the large smelter at San Luis Potosi.

MISSOURI, KANSAS & TEXAS.—This company, it is reported, is moving three miles of track between Ada and Konawa, Ind. T., from the Canadian river embankment to a new grade along the rock cliff. The work includes some new bridges at Tyrola. It will both shorten the line and eliminate danger from floods.

MORGANTOWN & KINGWOOD.—Local reports state that this road has finished the 20-mile extension to Rowlesburg. The line now extends from Morgantown, W. Va., southeast to Rowlesburg, 50 miles. (May 17, p. 695.)

NEW ORLEANS GREAT NORTHERN.—Track on the branch from Rio, La., northwest via Franklinton to Tylertown, Miss., 41 miles, has been laid, and it is expected that the branch will be put in operation this month.

NEW YORK CITY RAILWAY.—This company has begun the work of changing the First avenue horse car line from Fifty-ninth street north so that it can be operated by the underground trolley system. Later a similar change is to be made below Fifty-ninth street.

OMAHA, LINCOLN & BEATRICE (ELECTRIC).—Work, it is said, is to be resumed on this line, building from Omaha, Neb., southwest to Lincoln, 56 miles. About 14 miles is finished. E. C. Hurd, General Manager, Lincoln.

ONTARIO ROADS (ELECTRIC).—Plans, it is said, are under way to build an electric line from Fort Francis, Ont., southwest, about 150 miles to Duluth, Minn. W. H. Elliott, of Fort Francis, and other local capitalists are interested.

PENSACOLA, ALABAMA & GEORGIA.—Application has been made in Florida by a company under this name to build a line from Pensacola, Fla., northeast to Andalusia, La., 75 miles. The project is being promoted by residents of Pensacola, and is supposed locally to be backed by the Central of Georgia.

RANDOLPH & CUMBERLAND.—This company, operating the old Carthage Railroad from Cameron, N. C., northwest to Hallison, 18 miles, is planning to extend the road southeast to Southport, 216 miles. (March 15, p. 390.)

SACRAMENTO VALLEY & EASTERN.—This company, it is said, has finished 10 miles of road between a point on the Southern Pacific near Kennet, Cal., and the works of the Bully Hill Copper Company at De Lamar. When finished the road will be 18 miles long. (March 15, p. 391.)

Shawnee Central.—This company, recently incorporated in Oklahoma with $10,000,000 capital and office at Shawnee, has surveys made and rights of way secured for about 50 miles on its proposed line from Shawnee, Okla., east to Muskogee, Ind. T., about 90 miles. Contracts for the work, it is said, will shortly be let. J. M. Aydelotte, President, and F. H. Peckham, Chief Engineer, Shawnee, Okla. (May 31, p. 760.)

Sikeston & Southeastern.—An officer writes that contracts will be let this fall for building this proposed line from Sikeston, Mo., north via East Prairie to Hickman, about 30 miles. A. J. Matthews, President, Sikeston, and J. E. Warner, Chief Engineer, Benton.

Southern Indiana.—See Chicago Southern.

Southern Pacific.—The Mexican Engineering & Construction Company of Mexico City has a contract for building the first 32 miles of road of the Cananea, Yaqui River & Pacific west from Orendain, Mex. Connection is to be made with the Mexican Central at Orendain.

Spokane & Inland Empire (Electric).—This company, which recently opened its line from Spokane, Wash., south as far as Oakesdale, announces that the road, originally intended to be built only as far as Moscow, Idaho, is to be extended further south to Lewiston.

Utica & Mohawk Valley (Electric).—Announcement is reported made by General Manager C. Loomis Allen that an electric road is to be built from Rome, N. Y., to Oneida. The necessary franchises have been obtained, and the work will be started as soon as financial arrangements can be made.

Valley River.—Incorporated in West Virginia with $50,000 capital to build a line from Mill Creek, W. Va., southwest to Clovercreek, Va., about 40 miles. The office of the company is at Mill Creek. The incorporators include: J. G. Huffman, Jr., and F. C. Huffman, of Wheeling, W. Va.; N. Heuch and W. A. Donnell, of York, Pa., and L. E. Schull, of Mill Creek.

Western & Atlantic.—Application has been made to the state legislature for permission to extend the terminals of this company at Chattanooga, Tenn., to the Tennessee river.

RAILROAD CORPORATION NEWS.

Atlanta, Birmingham & Atlantic.—N. W. Harris & Co., New York and Boston, are offering at a price to yield 6⅜ per cent. $1,720,000 5 per cent. equipment trust notes dated July, 1907, and falling due in 20 equal semi-annual instalments beginning January 1, 1908. The bonds are secured on 1,200 coal cars, 500 box cars, 300 flat cars, 30 cabooses and 25 locomotives costing approximately $2,145,000.

Baltimore, Chesapeake & Atlantic.—A semi-annual dividend of 2 per cent. on the $1,500,000 cumulative 5 per cent. preferred stock has been declared. The annual rate was 2 per cent. in 1905 and 3 per cent. in 1906.

Baltimore & Ohio.—See Washington Terminal Company.

Boston & Lowell.—The Massachusetts Railroad Commission has approved an issue of $250,000 stock of this company to reimburse the Boston & Maine for improvements and additions. The new stock, which will make $6,849,400 outstanding, being the total authorized issue, will be sold at public auction for not less than par value.

Boston & Maine.—See Boston & Lowell.

Buffalo & Susquehanna.—N. W. Harris & Co., New York and Boston, are offering, at a price to yield 6 per cent., $540,000 5 per cent. equipment bonds, series "B" dated April 1, 1907, and falling due in 20 semi-annual instalments beginning October 1, 1907. The bonds are secured on 500 steel gondolas, four passenger cars, two combination passenger and baggage cars and five consolidation locomotives costing about $640,000.

Chicago & Eastern Illinois.—Speyer & Co., New York, have agreed to underwrite $3,085,000 general consolidated and first mortgage, 5 per cent. bonds of 1937, which are to be issued to retire $2,376,800 first mortgage, 6 per cent. bonds maturing next December and $150,000 first mortgage, 7 per cent. bonds of the Indiana Block Coal Railroad, maturing next July. The general consolidated and first mortgage bonds are part of an authorized issue of $30,000,000, of which $16,583,000 is already outstanding. The present issue is part of $6,403,000 reserved to retire prior lien bonds.

Chicago, Peoria & St. Louis.—The January 1 interest on the 2,000,000 consolidated mortgage 5 per cent. 30-year bonds was paid on June 25. The payment of the preceding semi-annual interest was similarly delayed.

Chicago, Rock Island & El Paso.—See El Paso & Southwestern.

Chicago Southern.—The July 1 interest on the $4,000,000 two-year, 5 per cent. notes has been paid. About 75 per cent. of the issue has been deposited with the Girard Trust Company of Philadelphia under the terms of the plan for exchanging them for their par value in first mortgage, 5 per cent., 30-year, together with 25 per cent. par value of common stock of the Southern Indiana, which is owned by the same interests. See construction column.

Denver City Tramway Company.—See Denver, North-Western & Pacific.

Denver, North-Western & Pacific.—The President of this company is said to have sold his holdings in the Denver City Tramway Company to Eastern interests, including D. C. Clark and W. L. Bull, of New York, and Marsden J. Perry, Benjamin A. Jackson and Samuel M. Colt, of Providence, R. I. The proceeds of the sale are to be used toward paying for the completion of the D., N-W., & P.

El Paso & Southwestern.—It is understood that this company has taken over the Chicago, Rock Island & El Paso line from Santa Rosa to Tucumcari, 59 miles.

Mexican Central.—Some of the income bondholders, including Alexander Morton, of London, and certain New York bankers, have demanded an examination of the books of the company in order to find out the amount of income properly applicable to interest payment on these securities. There are three classes of income bonds, aggregating $32,179,900 outstanding, on which no interest has been paid for 15 years. See National Railways of Mexico.

National Lines of Mexico.—See National Railways of Mexico.

National Railways of Mexico.—This is the name of the company in which the National Lines of Mexico and the Mexican Central are to be merged. It will have $30,000,000 4 per cent. non-cumulative preferred, $125,000,000 5 per cent. non-cumulative second preferred and $75,000,000 common stock. The common and second preferred are to share equally in dividends after the regular dividends on both first and second preferred have been paid. There are to be issued $231,000,000 4½ per cent. preferred mortgage bonds and $186,000,000 4 per cent. general mortgage bonds. The principal and interest of the last named securities are to be guaranteed by the government. The terms on which these securities are to be exchanged for old securities are not yet announced. A syndicate headed by Ladenburg, Thalmann & Co., New York, has been formed to bring out the bonds. The Mexican Central has outstanding $59,454,300 stock and $142,173,000 bonds and notes, and the National Lines of Mexico have $93,403,000 stock and $96,029,000 bonds and notes. The Mexican Central has about 3,350 miles of road and the National Lines about 3,500. The Tehuantepec National is not included in the merger.

Philadelphia, Baltimore & Washington.—See Washington Terminal Company.

Southern Indiana.—See Chicago Southern.

Topeka & Northwestern.—This company, which built 38 miles of the cut-off on the main line of the Union Pacific from Menoken, Kan., to Marysville, 70 miles, has made a mortgage securing $6,000,000 6 per cent. bonds of 1957. It is understood that the bonds are to be turned over to the Union Pacific in payment of the cost of the cut-off.

Union Pacific.—See Topeka & Northwestern.

United Railways Investment Company.—At a meeting to be held July 23, the stockholders are to be asked to authorize the issue of $3,000,000 three-year, 6 per cent. notes and the acquisition of the $1,000,000 ten-year, 5 per cent. notes of the United Railroads of San Francisco.

United Railroads of San Francisco.—See United Railways Investment Company.

Wabash.—The directors have declared an interest payment of 6 per cent. on the $3,500,000 debenture "A" 6 per cent. bonds and 1 per cent. on the $26,500,000 debenture "B" non-cumulative 6 per cent. bonds. No interest had been paid on the debenture "A's" since July, 1904, and no interest had ever been paid on the debenture "B's." The plan for retiring both classes of debentures was agreed on last December. (Dec. 28, 1906, p. 184.)

Washington (D. C.) Terminal Company.—Brown Bros. & Co. have bought $1,575,000 two-year 5 per cent. notes to be dated August 1, 1907. They are secured on $2,000,000 first mortgage 4 per cent. bonds of 1945, and are guaranteed principal and interest by the Baltimore & Ohio and the Philadelphia, Baltimore & Washington.